BROOKHAVEN NATIONAL LABORATORY

U.S. ATLAS PROJECT OFFICE

Physics Department
UPTON, NEW YORK 11973

August 22, 2001

Mr. James Yeck
Department of Energy
Fermi Group
POB 2000
Batavia, IL 60510

Dr. Thomas Kirk
Associate Laboratory Director
Brookhaven National Laboratory
Upton, NY 11973

SUBJECT: U.S. ATLAS Project Monthly Status Report for June 2001

Dear Sirs:

Attached please find Monthly Status Report No. 40 for the U.S. ATLAS Project.

Sincerely yours,

William J. Willis
U.S. ATLAS Project Manager

Distribution:

Abolins, M.
Alam, S.
Baker, K.
Barnett, M.
Bensinger, J.
Blair, R.
Butehorn, C.
Carolan, P. - DOE
Cleland, W.
Crawford, G.
Cullen, J. – PAP
De, K.
Dodd, J.
Ernst, R.
Errede, S.
Feldman, G.
Gilchriese, M.
Goldberg, M. - NSF
Gordon, H.
Firestone, A. - NSF
Harrison, M. – PAP
Hinchliffe, I.
Huth, J.
Kagan, H.
Kane, S.
Kirby, D.
Kirk, T.
Lankford, A.
Larsen, R. - PAP
Lissauer, D.
Lubatti, H.
Mantsch, P. - PAP
Murtagh, M.
Neal, H.
Norton, S.
Ogren, H.
Oh, S.
Parsons, J.
Pilcher, J.
Polychronakos, V.
Premisler, L.
Price, L.
Rijssenbeek, M.
Ritchie, J., DOE
Rutherfoord, J.
Seiden, A.
Seidel, S.
Siegrist, J.
Sikinger, P.
Sinkular, M., NSF
Skubic, P.
Slattery, P.
Sliwa, K.
Sondericker, J.
Stroynowski, R.
Taylor, F.
Toohig, T., DOE
Tuts, M. – PAP
Whitaker, S.
Wolbers, S. - PAP
Williams, H.
Willis, W.
Wu, S.L.
Yeck, J.

U.S. ATLAS

PROJECT STATUS REPORT NO. 40

REPORTING PERIOD

JUNE 2001

TABLE OF CONTENTS

1. PROJECT OBJECTIVE

The U.S. ATLAS Project consists of the activities to design, supply, install and commission the U.S. portion of the ATLAS detector. The detector will become part of the Large Hadron Collider (LHC) at CERN, the European Laboratory for Particle Physics. The ATLAS detector is being designed to understand the dynamics of electroweak symmetry breaking. The U.S. ATLAS collaboration is funded jointly by the U.S. Department of Energy and the National Science Foundation.

The fundamental unanswered problem of elementary particle physics relates to the understanding of the mechanism that generates the masses of the W and Z gauge bosons and of quarks and leptons. To attack this problem, one requires an experiment that can produce a large rate of particle collisions of very high energy. The LHC will collide protons against protons every 25 ns with a center-of-mass energy of 14 TeV and a design luminosity of 10^{34} cm^{-2} s^{-1}. It will probably require a few years after turn-on to reach the full design luminosity.

The detector will have to be capable of reconstructing the interesting final states. It must be designed to fully utilize the high luminosity so that detailed studies of rare phenomena can be carried out. While the primary goal of the experiment is to determine the mechanism of electroweak symmetry breaking via the detection of Higgs bosons, supersymmetric particles or structure in the WW scattering amplitude, the new energy regime will also offer the opportunity to probe for quark substructure or discover new exotic particles. The detector must be sufficiently versatile to detect and identify the final state products of these processes. In particular, it must be capable of reconstructing the momenta and directions of quarks (hadronic jets, tagged by their flavors where possible), electrons, muons, taus, and photons, and be sensitive to energy carried off by weakly interacting particles such as neutrinos that cannot be directly detected. The ATLAS detector will have all of these capabilities.

The ATLAS detector is expected to operate for twenty or more years at the CERN LHC, observing collisions of protons, and recording more than 10^7 events per year. The critical objectives to achieve these goals are:

- Excellent photon and electron identification capability, as well as energy and directional resolution.
- Efficient charged particle track reconstruction and good momentum resolution.
- Excellent muon identification capability and momentum resolution.
- Well-understood trigger system to go from 1 GHz raw interaction rate to ~100 Hz readout rate without loss of interesting signals.
- Hermetic calorimetry coverage to allow accurate measurement of direction and magnitude of energy flow, and excellent reconstruction of missing transverse momentum.
- Efficient tagging of b-decays and b-jets.

The U.S. ATLAS cost objective is \$163.75M while supplying initially the work scope described in Appendix 3 of the Project Management Plan (PMP) and, if possible, all the goals described in Appendix 2 of the PMP.

The ATLAS project was initiated in FY 1996, and is scheduled for a 10-year design and fabrication period beginning in the first quarter of FY 1996, and finishing in FY 2005. This period will be followed by operation at the LHC.

2. TECHNICAL APPROACH CHANGES

No change.

3. PROJECT MANAGER'S SUMMARY ASSESSMENT – W. Willis

The annual Overview meeting of the ATLAS Collaboration took place at Brookhaven National Laboratory this month. It was well-attended, with more than 200 collaborators from approximately 26 countries. The organization was excellent, I thought, thanks to the dedicated efforts of Howard Gordon and Jackie Mooney and others, and even the weather was cooperative. There was an excellent Outreach evening session, with a good attendance by the public, thanks to an interesting talk by Dava Sobel, with a number of talks on the Quarknet program by participants. There were good surveys of all the current status of the technical systems and the physics issues in ATLAS. The nature of the organization and physical setup were perhaps more conducive to real work than the regular meetings at CERN, and the subgroups got a lot done.

One of the important events was a meeting of the Working Group on (U.S.) Management Contingency. This group has indeed become, as we expected, the de facto venue for planning for the Staging of ATLAS, and more generally the planning for the strategy of turning on a working experiment in the face of under funded systems and uncertain schedule delays in ATLAS and the LHC. We addressed the priority-ordered list of Management Contingency items maintained in the U.S. ATLAS Project and discussed proposals for the U.S. to pick up items on this list by Base Line Change actions. The only actions taken previously were relatively small additions to be able to complete the Tile Calorimeter, a successful construction, which is the first dectector in the ATLAS installation sequence. On the table in this meeting were larger items, with the first being the U.S. contribution to the new organization of ATLAS Technical Coordination for Integration. This could be controversial among ATLAS physicists since it was not part of our original list of deliverables, and its funding will inevitably cut into the delivery of detector equipment that ATLAS needs and U.S. teams are anxious to provide. Nevertheless, the U.S. ATLAS Executive Committee unanimously supports this action because of the clear need and the risks of leaving this area drastically unsupported. The Working Group in this meeting came to the same conclusion, with some encouragement by the Spokesperson. The next item was action on the $1.6M U.S. obligation required as part of the agreement for full funding of the Liquid Argon Front End Board electronics. This agreement was discussed in this space last month, where an overall plan has been generated among all the parties with the aid of funds from the CERN ATLAS group. This item had the strong support of the ATLAS management, who put a lot of effort into reaching this agreement, essential for the first-stage configuration of ATLAS, and was accepted. This was the end of positive action at this meeting, though other items were discussed.

We have commended the three U.S. ATLAS Muon MDT detector sites for their successful completion of the first set of sixteen chambers at each site, all within the schedule established a year ago. They are now installing the tooling for the next set, with altered dimensions. Their parts flow has now created generous reserves for the future production.

We have added Technical Progress for WBS 1.10 – Technical Coordination with this report.

4. TECHNICAL PROGRESS - SUBSYSTEM MANGERS' SUMMARIES

1.1 Subsystem Manager's Summary Murdock Gilchriese (Lawrence Berkeley Lab.)

1.1.1 Pixels

Mechanics activities are proceeding well and are on or about on schedule. A Conceptual Design Review of all of the pixel mechanics and a PRR of the Local Supports will be held in July.

The evaluation of sensor preproduction from one vendor (CIS) is nearing completion and all results are so far positive. Deliveries from Tesla continue to be delayed although it is claimed that production issues have been resolved.

The IBM FE IC design was reviewed in June. About a 2 month delay in submission and about a one month delay in the delivery of wafers (recent fabrication times have been less than we assumed in ETC01) is currently projected.

The completion of the flex hybrid layout has been delayed to allow for two versions, one compatible with the existing MCC chip and one compatible with a 0.25-micron version. The projected delay does yet affect the overall schedule - the IC submission remains the critical path item.

Dummy bump-bonded module production has been slowed by our inability to produce high quality dummy 8" wafers. Another order is underway with modifications that we hope will fix the problems.

1.1.2 Silicon Strips

The ABCD PRR was held in early July and passed. The first production release will occur by mid-July and the first production ICs will arrive in August (lots had already been started). The next production lots will arrive in mid-October, and then at a rate of 100 wafers every two weeks until the initial release order is completed by the end of 2001. This is roughly a factor of two faster than was estimated in ETC01.

The production of the critical components for module assembly are either in progress (about 20% of production sensors have been fabricated) or orders placed (hybrids and baseboards). Production-quality components for module assembly should be delivered by October.

1.1.3 ReadOut Drivers

The Cambridge system test appears to be successful so far. The system test has been successful enough so that the layout of the production model card (the prototype with design errors fixed and other improvements) should begin in July. Fabrication of the ten or so production model boards may occur as early as September. If this schedule is held, we will be about five months behind the ETC01 schedule. It's also apparent that the SCT and pixel ROD schedules will have to be decoupled more than has been assumed for ETC01. The SCT needs are at least one year earlier than the pixels.

1.2 Subsystem Manager's Summary **Harold Ogren (Indiana University)**

1.2.1 Mechanics

Component systems continued in production during June.

Six modules are completed at Indiana, seven modules completed at Duke, and eight modules in production. Gain tests on three type 2 modules have been carried out at Duke, and one type 1 module from Indiana will soon start gain tests at Duke.

Module 2.1 is being used at University of Pennsylvania for systems tests, 1.02 is at Duke for gain tests and module 1.01 at Dubna, having been irradiated in a reactor. Several other tests have been completed. Duke University has completed a microdischarge test on the HV plates, and a direct Xe leak measurement on a completed module. This shows that our leak-testing limit of 0.1 mBar/Bar/min is well within our requirement of five volume losses per year.

1.2.5 Electronics:

The first wafers of the DMILL January 15th submission were delivered to us last month, but the wafers failed (over large areas) to meet one of the DMILL poly isolation resistances. Nevertheless, we had one wafer diced and 20 copies of the ASDBLR (and 20 copies of the DTMROC) were bonded into ceramic test packages. These first 20 die have now been measured and we now know that all of the design improvements in this run were successful. In particular the parametric yield has dramatically improved since the threshold variations are much smaller.

TEMIC has reprocessed all the wafers. They will be delivered to CERN on 2 July and so "claimed good" devices should be available in TQFP packaging in three or four weeks - these devices will allow us to make statistically significant statements on the above measurements.

Additional stamp boards have been bonded at Lund and are now being tested at Penn. The initial flexboards are operational, but show more noise and crosstalk than anticipated. A further design step will be needed.

1.3 Subsystem Manager's Summary **Richard Stroynowski (Southern Methodist University)**

At the time of this writing the cryostat arrived at CERN. The preparation for its unpacking and acceptance tests will be initiated in July. The production of signal feedthroughs proceeds well and on schedule. The training for their installation has started at BNL. Mechanical components of the HV feedthrough are close to being ready for shipment to CERN. The installation schedule has been revisited. Because the HV cables are long and easily contaminated by dirt, it was decided to install the mechanical structures first and to postpone the cable installation until the work on all signal feedthroughs will be completed. The procurement for the liquid nitrogen refrigerator has not yet converged and the negotiations with the bidders continue.

The work on the Front End Board design has been pushed as far as possible. The functionality of all DMILL-radiation tolerant-chips has been tested using "1/4 FEB" test system. DSM chips will be available in July. The last missing radiation test with protons of the G-link chips has been completed and the optical links are ready for production. The availability of radiation resistant voltage regulators remains to be the largest uncertainty in the FEB design. CERN sponsored development of such regulators at the Thompson

S.A. is now expected to produce first prototypes in November. The delay of over a year in the voltage regulators availability has a potential for introducing a substantial delay in the FEB design and production. A large fraction of effort and manpower is being re-directed to study alternative solutions.

The production of the preamplifier hybrids, layer sum boards and of the motherboards is progressing steadily. However, a potential problem with the resistor networks has been identified in the cold tests of the completed modules. High voltage sparking in some cases can change the values of the resistance of the thin film resistors. These resistors are used in calibration of the module energy responses. A task force has been set up to study the problem and its potential solutions with the decision to be taken in October.

The stacking of the FCAL 1C module has been completed and the installation of the tubes has started. The FCAL group proposed to change the detail design of the FCAL-1A from the rotational to mirror symmetry of the FCAL-1C. The proposal has been accepted by the LArg collaboration and will require only minor machining changes.

1.4 Subsystem Manager's Summary **Lawrence Price (Argonne National Lab.)**

Submodule and module assembly and instrumentation is proceeding well. In particular, 49 special submodules have now been constructed, so that variation on submodules is all well under control. 36 modules have been assembled mechanically and 26 have been instrumented, tested, and shipped to CERN. Production of 3-in-1 cards was complete in May and 51% were tested and burned-in by the end of June. Mother Boards are arriving from the vendor on schedule, and burn-in and testing have begun. ITC submodule shipments are on schedule and good success has been achieved in recovering improperly cut master plates.

1.5 Subsystem Manager's Summary **Frank Taylor (MIT)**

Progress on design and construction of the Endcap Muon System continued on several fronts during June.

All U.S. MDT chamber sites completed the construction of their first chamber series and have started retooling for the next chamber series. Tube production commenced for the production of tubes of the next chamber series at all three sites and is now well ahead of schedule. Delivery of parts for tube and base chamber construction has been in most cases well ahead of need and in all cases off the critical path. Of note is that 11,000 'MPI' endplugs were delivered to Boston. These will serve as backup inventory in case the NIEF plugs are in short supply.

Base chamber production for Series I finished on - or ahead of schedule (16 chambers produced at each U.S. chamber site). However, the retooling for the next chamber series has proven to be more difficult and time-consuming than planned. The layout of the stiffbacks, optical monitoring systems, sphere blocks, clamps, etc. was started at each of the three U.S. chamber sites.

Of note is a troublesome bowing of the precision angle combs of the previous chamber series observed at both Seattle and Michigan. Both sites noticed that the angle combs, so precisely surveyed in place at the start of the first 16 chambers of Series I, have become bowed by about 30 microns upward after all 16 chambers were made. Even with this bow the combs remained within the 20-micron RMS specification during the construction but the effect is of concern and was studied during June. The combs for the second series of chambers will be clamped at their Bessel points and should be better controlled. No bowing was observed at the BMC site. The second Michigan chamber, presumably made with bowed angle combs, was recently x-rayed and found to pass the ATLAS precision criteria.

Parts for the gas system and Faraday cage continued in production during June. About 95% of the gas tubeletts have been delivered to Harvard from our domestic supplier. They will cover roughly 20 MDT chambers and will be used at the BMC and Michigan. The precision Heim tubeletts are under production in Germany. Gas bar production continues at Seattle. Essentially all of the gas blocks that distribute the gas on the MDT chambers were machined at Tufts. The 4x6 - 8.5 degree Faraday cage design was completed during June and pre-production samples of both of the 3x8 designs were received and delivered to Michigan and Seattle. It is anticipated that chamber services will be mounted on the chambers in production mode at the end of July.

Significant progress was reported on the MDT electronics and fabrication. The second (and hopefully final) octal ASD prototype, ASD01a, was received and its testing started. This new prototype is a small evolution from ASD00a that was successfully tested earlier this year. The remainder of the 10K Test Mezzanine Lite boards, 3x8 signal hedgehog boards and Mezz-CSM adaptor boxes were received and their testing started. It is anticipated that these components should be shipped out to the Muon Collaboration this August.

The layout for the production HV HedgeHog (HH) cards was finalized and tests started on their operation inside the Faraday cage. However, the production of HedgeHog boards is delayed because the capacitor vendor selected was found to be unacceptable to CERN. Both the U.S. high voltage and signal HH boards will be obtained through this CERN common procurement.

The CSM-1 has evolved into a more simple and robust design. As a consequence, it is anticipated by the Michigan electronics group (Chapman, et al.) that the first prototype will be complete in the spring of 2002 - ahead of schedule.

The start of CSC series production will likely be delayed until September in order to get all the documentation and procedures in line.

The design of the CSC readout electronics moved forward during June. Progress was made on the ROD motherboard design. Coding of the Sparsifier Processing Unit continued at UC-Irvine as did the coding on the Clock Generation drivers, the Host Processing Unit and the neutron Rejection Processing Unit.

The preamp - shaper was redesigned at BNL by O'Connor et al. for lower input impedance, cross-talk and the first fabrication run is expected in the July-August MOSIS run. (No warnings have been received from MOSIS about their discontinuing the chip fabrication process.) The new MUX chip has been identified, preliminary specifications compiled. The logic of the chip will be prototyped in an ALTERA MAX FPGA. In addition the CSC-BNL Electronics group is prototyping the circuit in a HP 0.5 micron chip that has the same functionality and pinout.

The alignment system personnel grappled with the design and setting up of the H8 system test at CERN (all phantom chamber frames are approximately in their position) and responding to the need to redesign some 16 out of 24 polar alignment stay-clear locations for the endcap global alignment system. These needed changes of the stay-clears are due to the design 'evolution' of the layout of the endcap muon system, barrel toroid voussoirs and struts, barrel toroid support feet, etc. The alignment group is working intensely with the CERN TC on solving these problems. In the meanwhile, the Brandeis alignment group continued to manufacture components for the in-plane alignment parts for the next chamber series production and long-wire DAQ system.

Daly of UW-Seattle reported that all the designs for the MDT chamber kinematic mounts are now complete. Work is now focused on the design of the MDT mount struts. This engineering can't be completed, however, until the designs of the Small and Big Wheels, the BT support structure that holds the EIL4 chambers are finalized. These are CERN responsibilities. The same caveats hold for work on the FEA of the wheels and integration of the alignment and gas systems on the chamber support structures. Final drawings for the Big Wheel design are not likely before March 15, 2002, according to Daly. Our need for more system integration engineering continues to be critical.

1.6 Subsystem Manager's Summary **Robert Blair (Argonne National Lab.)**

Preparations for the July TDAQ week have been the primary focus of attention during June. User requirements and design documents are being reviewed and an update to the level 1 level 2 interface document is being done. The evaluation of Athena and an attempt to feed back useful timing information to the offline developers is progressing. Some work on more economical ROD design has been done with an eye to using commodity Gigabit Ethernet instead of more specialized media.

1.10 Technical Coordination **D. Lissauer (BNL)**

Feet and Rails: The feet and rails design is making reasonable progress. There are still a lot of calculations missing. Conflicts with the forward alignment system were found that must be resolved.

Envelopes: The Task Force work also led to trying to finalize the envelopes in the experiment. New conflicts have been found. The most disturbing one is the EC Toroid that needs to be placed at a position that minimizes the magnetic forces between the Barrel and EC Toroid. Due to this fact, the uncertainty on the location of the Endcap Toroid is larger than had been anticipated in the envelope assignment.

ATLAS Engineering Organization: Slow progress is being made in recruiting new people to the Technical Coordination (TC) organization. The post for the Bachy replacement is open, and we expect at least a few candidates to apply. In addition, hiring a new Muon integration engineer is planned. There is some progress in getting the ST division (Technical Division) more involved in ATLAS engineering. Work packages for cooling have been identified and the manpower at ST has been secured.

Toroid Magnet: A review of the Toroid Magnet warm structure took place at CERN. The present design has a few weak points where the safety margin needs to be increased. The main problem that was made clear during the review is the lack of communication between the design team at Saclay and the CERN team. Efforts will have to be made to improve communication. A potential problem with the interface between the magnet and the feet came up. It involved a fault condition of the magnet – if that happened the warm structure could cool down and shrink by few cm. It is not clear if the feet structure can take the load if such a fault occurs.

Activation: Additional calculations done by Russian colleagues have confirmed the initial calculations done by Vincent Hedberg. The activation level in the experiment is higher than anticipated earlier. Some areas will be very hard to access during shut down, and remote handling will be needed on some.

Shielding Disc: The design of the shielding disc is progressing. A new potential problem came up during the meeting. Part of the disc “nose” support is made of steel. The nose gets into very close contact with the End Cap Toroid magnet. The magnetic forces have not been calculated – this could require changing the material to stainless in the nose region.

Forward Shield: The interface between the forward shield and the Civil Engineering of the Hall has not been completed yet. The new forward shield design requires the shield to be supported from the cavern wall. The weight is 300 tons per end and this implies modification to the wall design. Worries were expressed that the cost for the changes might be high. (The Contractor is having difficulty with CERN on other issues.)

Schedule: Initial discussion took place on updating the installation schedule to reflect not just the main activities but also the parasitic activities that need to go in parallel, like cabling, commissioning, etc. Pilot projects to define the installation database for the Tile and Magnet systems are being discussed.

ECR Procedure: Six engineering change requests have been started using the new procedure.

5. OPEN ITEMS BETWEEN DOE/NSF AND U.S. ATLAS

a) Financial: There is $1,901,000 of available funding residing in management reserve and $9,489,000 of undistributed budget pending approval and implementation of MOU documents. Table7-2 contains the summary of FY01 funds distribution. There was $2,400,300 requested in additional funding allocations during June.

b) Schedule: None.

c) Technical: None.

6. SUMMARY ASSESSMENT AND FORECAST

1. Financial Status

A total of $96,288,000 (58.8%) was authorized, held in reserve or identified as undistributed budget of the $163.75M Total Project Cost Objective. The details of the overall project cost objective are presented in Table 6-1 reproduced overleaf from the U.S. ATLAS Project Plan as approved on 3/18/98 and revised to include cost changes approved through BCP #46.

The details of the reported costs and reported obligations are presented in the Table 7-1 in Section 7 of this report. In addition Table7-2 shows the cost breakdown by institution and funding source.

The relationship between budget authority/cost/obligations (including an estimate of other accrued costs and obligations) is presented in Figure 9-1 in Section 9 of this report.

The level 2 CSSR statistics are presented in section 10. Performance analysis is included for major subsystems in section 8 of this report.

2. Schedule Status

See details in Figure 11-1.

The overall schedule status report is found in section 11.

The milestone log from the PMP, including revised forecast dates, is reproduced as section 12.

3. Baseline Change Proposals

Forty seven BCPs were received through June 2001. Forty four BCP's were approved, two were withdrawn and one is pending approval.

Table 6-1 reflects all cost BCPs through 46.

TABLE 6-1: SUMMARY COST ESTIMATE

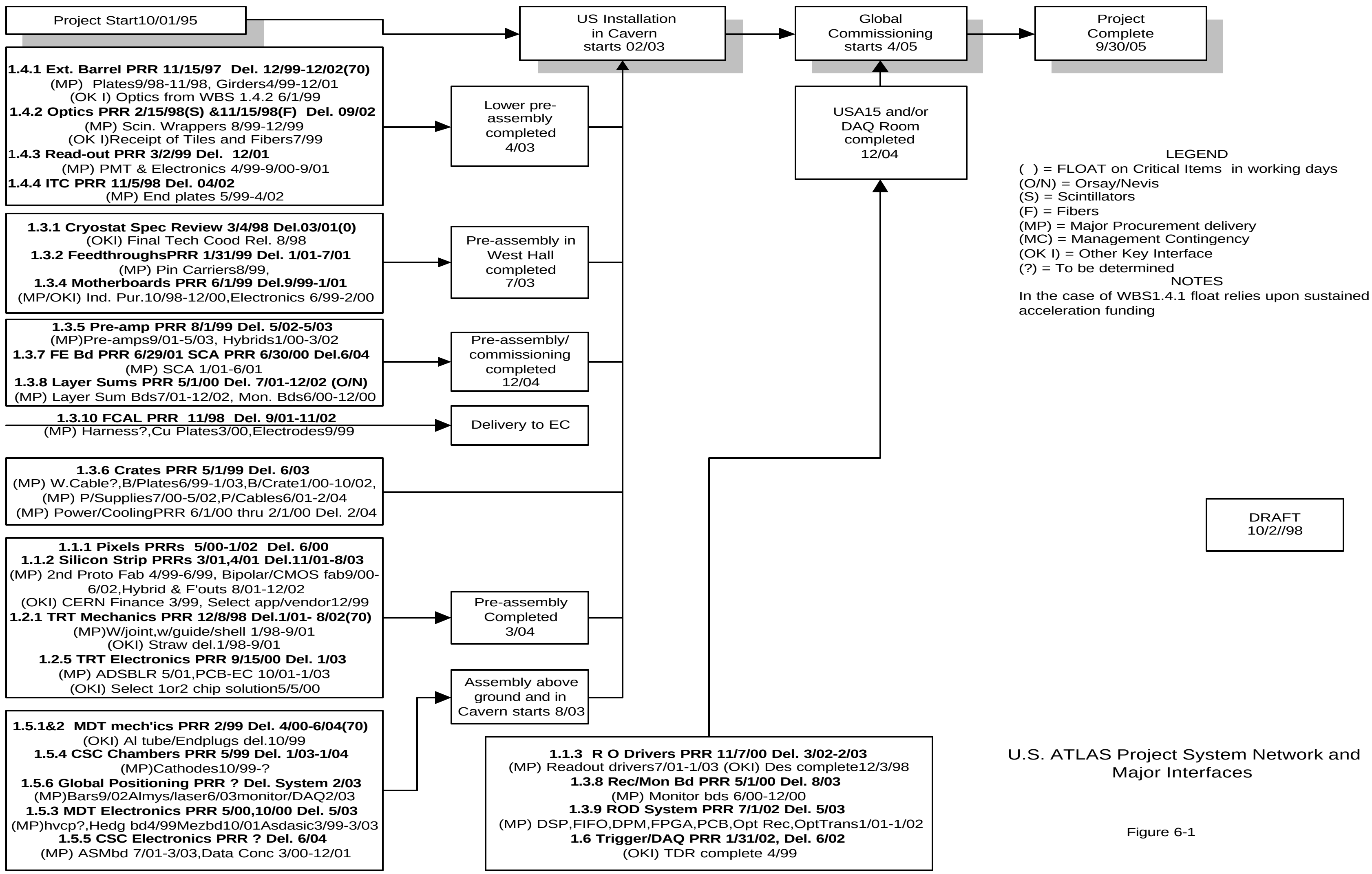
U.S.ATLAS Project
Summary Cost Estimate

Presented in (AY$ x 1000)

WBS No.	Description	Base Cost
	Technical Baseline	
1	U.S. ATLAS	
1.1	Silicon	17,755.1
1.2	TRT	9,194.0
1.3	LAr Calorimeter	42,171.6
1.4	Tile Calorimeter	9,148.2
1.5	Muon Spectrometer	26,391.2
1.7	Common Projects	9,179.1
1.8	Education	286.5
1.9	Project Management	8,279.0
1.10	Technical Coordination	450.0
	Subtotal	**122,854.7**
1.6	Trigger/DAQ Pre-Technical Baseline	3,117.9
	Subtotal	**3,117.9**
	Management Contingency	**10,471.9**
	Contingency	**19,466.1**
	Subtotal	**29,937.9**
	Technical Baseline	**155,910.5**
Items Outside of Approved Technical Baseline		
1.1.1	Pixels	-
1.6	Trigger/DAQ	**7,839.5**
	Subtotal	**7,839.5**
	Total Project Cost**	**163,750.0**

** Assumes funding profile of FY96=$1.7M, FY97=$3.7M, FY98=$10.05M,, FY99=$25.63 FY00=$28.4M, FY01=$26.8M, FY02=$21.9M, FY03=$25.9M,FY04=$14.7M, FY05=$5.0M.
project completion in 2005.
Includes cost changes for BCP 1-46

Figure 6-1 - Project System Network



FUNDING

Table 7.1 - Summary of Funds Authorized & Total Costs and Commitments to Date

U.S. ATLAS Project
Summary of Funds Authorized
and
Total Costs and Commitments to Date
June 30, 2001
(AY$ x 1,000)

WBS No.	Description	Funds Authorized Thru FY01	Expenses + Commitments: Expenses to Date	Open Commit	Total to Date	Balance of Authorized Funds
1.1	Silicon	12,248	8,638	101	8,738	3,510
1.2	TRT	6,958	4,880	1,057	5,937	1,020
1.3	LAr Calorimeter	27,861	20,774	4,330	25,104	2,757
1.4	Tile Calorimeter	8,216	7,005	132	7,138	1,078
1.5	Muon Spectrometer	16,953	12,359	1,354	13,713	3,240
1.6	Trigger/DAQ	1,977	1,616	1	1,616	361
1.7	Common Projects	5,300	5,132	-	5,132	168
1.8	Education	49	45	-	45	4
1.9	Project Management	4,886	4,241	-	4,241	645
1.10	Technical Coordination	450	87		87	363
	Subtotal	84,898	64,777	6,975	71,753	13,145
	Management Reserve	1,901			-	1,901
	Contingency	-			-	-
	Subtotal	86,799	64,777	6,975	71,753	15,046
	Undistributed Budget	9,489			-	9,489
1	U.S. ATLAS Total AY$	96,288	64,777	6,975	71,753	24,535

Table 7.2 – FY01 Funds – U.S. ATLAS Summary by Institution and Subsystem

U.S. ATLAS
FY 01 Funds
WBS 1 U.S. ATLAS Summary
Presented in (AY$x1,000)
Status as of 06/30/01

WBS 1.3 Liquid Argon		WBS 1.4 Tile			WBS 1.5 Muon			WBS 1.6 Trigger/DAQ			WBS 1.7 Common Projects			WBS 1.8 Education		WBS 1.9 Proj Mgmt			WBS 1.10 Tech Coord			WBS 1 U.S. ATLAS Total FY01			
DOE	NSF	DOE		NSF	DOE		NSF	DOE		NSF	DOE		NSF	DOE	NSF	DOE		NSF	DOE		NSF	DOE		NSF	
Contract		Grant	Contract		Grant	Contract		Grant	Contract		Grant	Contract				Grant	Contract		Grant	Contract		Grant	Contract		Total
	-		500		-		-		72		-	-	-	-	-	-		-	-		-	-	572	-	572
844	-					962					-	4,000	-	-	-	-	669		-	450		-	6,925	-	6,925
	-										-	-	-	-	-	-			-			-	1,575	-	1,575
	-										-	-	-	-	-	-			-			-	-	-	-
	-										-	-	-	-	-	-			-			298	-	-	298
	-				155						-	-	-	-	-	-			-			155	-	-	155
	-						731				-	-	-	-	-	-			-			-	-	731	731
	-				-		183			83	-	-	-	-	-	-			-			-	-	266	266
	-										-	-	-	-	-	-			-			-	-	2,702	2,702
	-			723							-	-	-	-	-	-			-			-	-	723	723
	-										-	-	-	-	-	-			-			501	-	-	501
	-										-	-	-	-	-	-			-			-	-	331	331
	-						3,882				-	-	-	-	-	-			-			-	-	3,882	3,882
	-	76									-	-	-	-	-	-			-			76	-	-	76
	-										-	-	-	-	-	-			-			-	616	-	616
	-				190	100					-	-	-	-	-	-			-			190	100	-	290
	-			-						-	-	-	-	-	-	-			-			-	-	-	-
	-										-	-	-	-	-	-		103	-		-	-	-	103	103
											-	-	-	-	-	-		-	-		-	-	80	-	80
											-	-	-	-	-	-		-	-		-	-	-	-	-
																						-			-
					681						-	-	-	-	-	-		-	-		-	681	-	-	681
											-	-	-	-	-	-		-	-		-	-	-	426	426
											-	-	-	-	-	-		-	-		-	679	-	-	679
50	201										-	-	-	-	-	-		-	-		-	-	50	201	251
	-										-	-	-	-	-	-		-	-		-	-	-	-	-
				-							-	-	-	-	-	-		-	-		-	-	-	-	-
											-	-	-	-	-	-		-	-		-	67	-	-	67
	426										-	-	-	-	-	-		-	-		-	-	-	426	426
	-				-						-	-	-	-	-	-		-	-		-	-	-	-	-
	-						1,377				-	-	-	-	-	-		-	-		-	-	-	1,377	1,377
	-							98			-	-	-	-	-	-		-	-		-	1,112	-	-	1,112
894	627	76	500	723	1,027	1,062	6,174	98	72	83	-	4,000	-	-	-	-	669	103	-	450	-	3,778	9,918	11,169	24,865
	-	-		-					-	-		-					780	1,121		-	-	-	780	1,121	1,901
																	-	-		-	-	-	-	-	-
894	627	76	500	723	1,027	1,062	6,174	98	72	83	-	4,000	-	-	-	-	1,446	1,224	-	450	-	3,778	10,697	12,290	26,765

8. PERFORMANCE ANALYSIS

Status through the month of June 2001 reflects the new baseline schedules for all subsystems. The re-baseline date was established on October 1, 2000 and the Estimate to Complete 01 (ETC 01) was defined as all tasks and resources required to complete the project. All prior efforts were equated to the actual costs expended. The schedules are resource loaded to the baseline funding of $163,750K with Contingency, Management Contingency, and Items Outside of the Approved Baseline shown on separate lines and excludes all NSF R&D funds.

The CSSR in section 10 shows $65,053.9k of the work has been performed, which represents approximately 51.6 of the work authorized to date. There is an unfavorable schedule variance of ($961.5k) or 1.5% behind the plan. There is a favorable cost variance of $276.78k or 0.4% under spent for the work accomplished. There are outstanding commitments of $6,975.4k at this time that do not show up in the performance. This analysis will provide a breakdown of these variances into the individual subsystems and identify the specific tasks that cause these variances.

WBS 1.1 Silicon

Summary
The CSSR shows that $8,460.2k of the work has been completed which represents 47.6% of the total effort for the Silicon subsystem. There is an unfavorable schedule variance of ($313.0k) or 3.6% behind the plan and an unfavorable cost variance of ($177.5k) or 2.1% over spent for the work accomplished. There are outstanding commitments of $100.7k at this time that do not show up in the performance.

Schedule Variance
The unfavorable schedule variance is concentrated in the following WBS level 3 elements:

WBS 1.1.2 Silicon Strip System SV = ($80.4k)

- Hybrids/Cables/Fanouts are behind plan ($27.8k)
- Module Assembly and Test is behind plan ($52.6k)

WBS 1.1.3 RODs SV = ($232.6k)

- Design ROD Cards is behind plan ($16.9k)
- ROD Test Stand is behind plan ($59.3k)
- ROD Prototypes is behind plan ($51.2k)
- ROD Prototype Evaluation is behind plan ($17.8k)
- ROD Production Model is behind plan ($84.6k)
- ROD Fabrication is behind plan ($2.7k)

Cost Variance
There is a unfavorable cost variance of ($177.5k) which is distributed as follows: Pixel ($346.2k), the Silicon Strip System $268.9k and the ROD Design and Fabrication ($100.1k).

WBS 1.2 TRT

Summary

The CSSR shows that $4,885.7k of the work has been completed which represents 53.1% of the total effort for the TRT subsystem. There is an unfavorable schedule variance of ($252.8k) or 4.9% behind the plan and a favorable cost variance of $5.7k or 0.1% under spent for the work accomplished. There are outstanding commitments of $1,057.4k at this time that do not show up in the performance.

Schedule Variance

The unfavorable schedule variance is concentrated in the following WBS level 3 elements

WBS 1.2.1 Barrel Mechanics SV = ($247.9k)

- Detector Elements are behind plan ($31.2k)
- Component Assembly is behind plan ($108.4k)
- Module Assembly #2 (Duke) is behind plan ($44.3k)
- Module Assembly #1 (IU) is behind plan ($61.8k)

WBS 1.3 LAr

Summary

The CSSR shows that $21,570.4k of the work has been completed which represents 51.1% of the total effort for the LAr subsystem. There is an unfavorable schedule variance of ($189.4k) or 0.9% behind the plan and a favorable cost variance of $796.7k or 3.7% under spent for the work accomplished. There are outstanding commitments of $4,330.2k at this time that do not show up in the performance.

Schedule Variance

The unfavorable schedule variance is concentrated in the following WBS level 3 elements:

1.3.1 Barrel Cryostat SV = ($32.5k)
1.3.3 Cryogenics SV = ($23.8k)
1.3.10 Forward Calorimeter SV = ($119.4k)

- FCAL1 Module Production is behind plan ($32.4k)
- FCAL Electronics Design and Prototype are behind plan ($15.9k) and ($58.9k) respectively
- FCAL Production is behind plan ($12.1k)

Cost Variance

The favorable cost variance of $796.7k is a combination of positive and negative variances concentrated in the following WBS Level 3 elements.

- 131 Barrel Cryostat CV = $357.8k
- 132 Feedthroughs CV = ($113.7k)
- 133 Cryogenics CV = $728.3k
- 134 Readout Electrodes/MB CV = ($45.8k)
- 136 System Crate Integration CV = ($113.2k)
- 137 Front End Board CV = ($120.8k)
- 139 ROD System CV = $116.6k

WBS 1.4 Tile

Summary

The CSSR shows that $7,004.5k of the work has been completed which represents 76.6% of the total effort for the Tile subsystem. There is an unfavorable schedule variance of ($109.2k) or 1.5% behind the plan and a favorable cost variance of $1.0k or <0.1% under spent for the work accomplished. There are outstanding commitments of $132.2k at this time that do not show up in the performance.

Schedule Variance
The unfavorable schedule variance is concentrated in the following WBS level 3 elements:

1.4.3 Readout SV = ($92.2k)

- Front End Motherboard production is behind plan ($89.6k)

Cost Variance
There is a favorable cost variance of $7.1k which is distributed as follows:

- 141 EB Mechanics ($44.0k)
- 142 EB Optics ($39.0k)
- 143 Readout $126.3k
- 144 ITC ($36.1k)

WBS 1.5 Muon

Summary
The CSSR shows that $12,113.7k of the work has been completed which represents 45.9% of the total effort for the Muon subsystem. There is an unfavorable schedule variance of ($53.5k) or 0.4% behind the plan and an unfavorable cost variance of ($245.6k) or 2.0% over spent for the work accomplished. There are outstanding commitments of $1,345.2k at this time that do not show up in the performance.

Schedule Variance
The unfavorable schedule variance is concentrated in the following WBS level 3 elements:

1.5.8 MDT Supports SV = ($33.6k)

- Chamber Mount Struts Design is behind plan ($14.6k)
- Integration with Support Structure Design is behind plan ($19.2k)

Cost Variance
The unfavorable cost variance of ($245.6k) is a combination of positive and negative variances concentrated in the following WBS Level 3 elements.

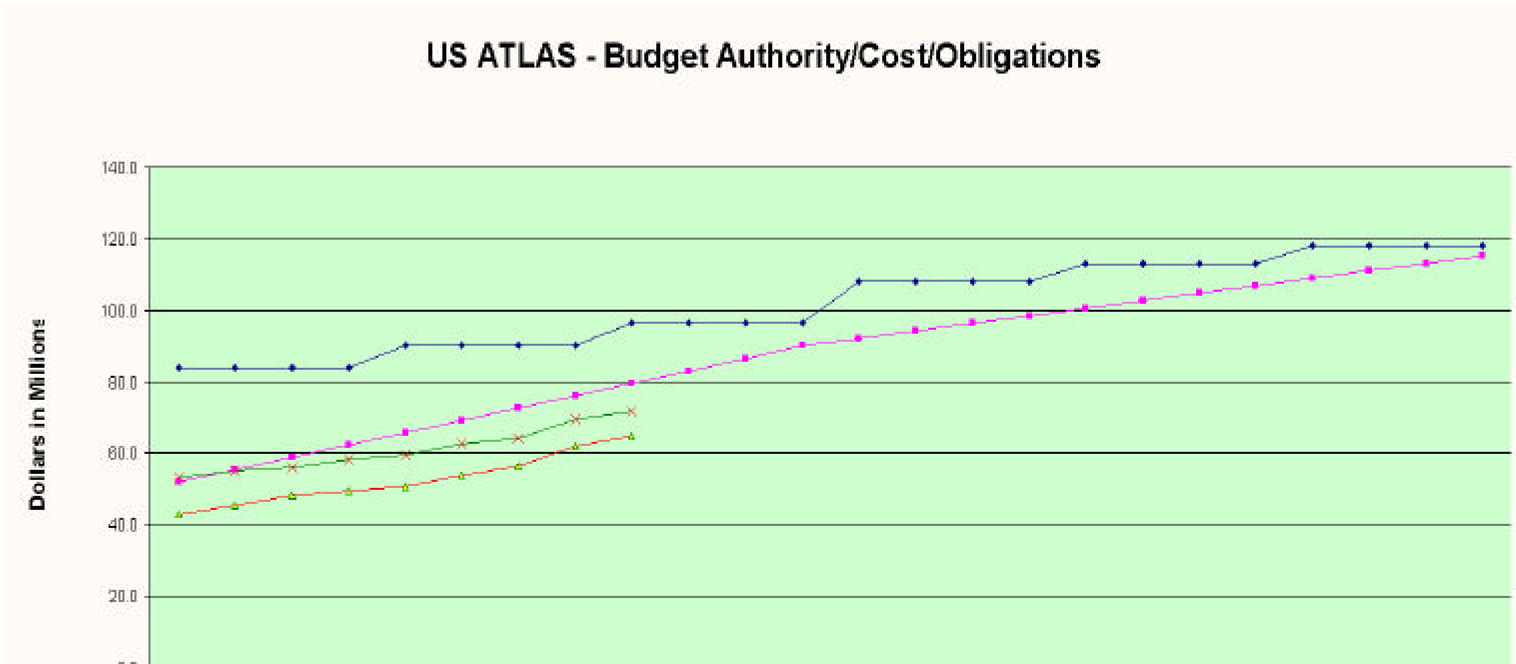
- 154 CSC Chambers CV = 0
- 157 MDT Chambers CV = ($100.4k)
- 158 MDT Supports CV = ($28.8k)
- 159 MDT Electronics CV = $46.5k
- 1511 CSC Electronics CV = ($49.6k)
- 1512 Global Align System CV = ($113.2k)

WBS 1.6 Trigger/DAQ

Summary
The CSSR shows that $1,514.1k of the work has been completed which represents 48.6% of the total effort for the Trigger/DAQ subsystem. There is an unfavorable schedule variance of ($43.7k) or 2.8% behind the plan and an unfavorable cost variance of ($101.5k) or 6.7% over spent for the work accomplished. There is an unfavorable cost variance of ($165.5k) for the Level 2 Supervisor but this is offset by a favorable cost variance of 80.3k for the Level 2 Calorimeter Trigger. The unfavorable cost

variances for the Level 2 SCT Trigger and the Architecture are ($8.4k) and ($8.0k) respectively. There are outstanding commitments of $0.7k at this time that do not show up in the performance.

9. BUDGET AUTHORITY COSTS AND OBLIGATIONS



	O 00	N 00	D 00	J 01	F 01	M 01	A 01	M 01	J 01	J 01	A 01	S 01
BA CUM	84.030	84.030	84.030	84.030	90.320	90.320	90.320	90.320	96.320	96.320	96.320	96.320
Plan Cost	52.078	55.530	58.981	62.433	65.884	69.336	72.787	76.239	79.691	83.142	86.594	90.045
Cost	42.874	45.510	48.302	49.611	50.849	53.849	56.299	62.165	64.777			
Cost+Oblig	53.367	55.051	56.073	58.241	59.391	62.703	64.202	69.508	71.753			

	O 01	N 01	D 01	J 02	F 02	M 02	A 02	M 02	J 02	J 02	A 02	S 02
BA CUM	108.170	108.170	108.170	108.170	113.170	113.170	113.170	113.170	118.170	118.170	118.170	118.170
Plan Cost	92.152	94.259	96.365	98.472	100.579	102.686	104.792	106.899	109.006	111.113	113.219	115.326
Cost												
Cost+Oblig												

Month-Year

10. WBS – COST SCHEDULE STATUS REPORT

Project Status Report
Section 10

U.S. ATLAS
Cost Schedule Status Report
Reporting Period Ending:06/30/01

	WBS Element	Cumulative To Date (k$)					At Completion (k$)			Complete (%)		
		Budgeted Cost		Actual Cost	Variance			Latest				
		Work Scheduled	Work Performed	Of Work Performed	Schedule	Cost	Budgeted AY $s	Revised Estimate	Variance	Scheduled	Performed	Actual
1.1	Silicon	8,773.2	8,460.2	8,637.6	(313.0)	(177.5)	17,755.1	17,755.1	-	49.4	47.6	48.6
1.2	TRT	5,138.6	4,885.7	4,880.0	(252.8)	5.7	9,194.0	9,194.0	0.0	55.9	53.1	53.1
1.3	Liquid Argon	21,759.8	21,570.4	20,773.8	(189.4)	796.7	42,171.6	42,171.6	0.0	51.6	51.1	49.3
1.4	TileCal	7,113.6	7,004.5	7,005.5	(109.2)	(1.0)	9,148.2	9,148.2	0.0	77.8	76.6	76.6
1.5	Muon	12,167.1	12,113.7	12,359.3	(53.5)	(245.6)	26,391.2	26,391.2	-	46.1	45.9	46.8
1.6	Trigger/DAQ	1,557.8	1,514.1	1,615.6	(43.7)	(101.5)	3,117.9	3,117.9	(0.0)	50.0	48.6	51.8
1.7	Common Projects [1]	5,132.2	5,132.2	5,132.2	-	-	9,179.1	9,179.1	-	55.9	55.9	55.9
1.8	Education [1]	45.1	45.1	45.1	-	-	286.5	286.5	-	15.7	15.7	15.7
1.9	Project Management [1]	4,241.0	4,241.0	4,241.0	-	-	8,279.0	8,279.0	-	51.2	51.2	51.2
1.10	Technical Coordination	87.1	87.1	87.1	-	-	450.0	450.0	-	19.4	19.4	19.4
Sub Total		66,015.5	65,053.9	64,777.2	(961.5)	276.7	125,972.6	125,972.6	0.0	52.4	51.6	51.4
Management Reserve							0.0	0.0	-			
Contingency							19,466.1	19,466.1	-			
Management Contingency							10,471.9	10,471.9	-			
Items Outside of Approved Baseline							7,839.5	7,839.5	0.0			
Escalation							0.0	0.0	-			
U.S. ATLAS Total		66,015.5	65,053.9	64,777.2	(961.5)	276.7	163,750.0	163,750.0	0.0	40.3	39.7	39.6

Notes: 1 LOE

FIGURE 11-1 - MILESTONE SCHEDULE STATUS REPORT

ID	Milestone	ETC 01 Baseline	Forecast	Actual
1	Project Start (10/1/95)	Sun 10/1/95	Sun 10/1/95	Sun 10/1/95
2	Start Submodule Procurement	Mon 9/1/97	Mon 9/1/97	Mon 9/1/97
3	Technology Choice for F/E Electronics	Sat 11/15/97	Sat 11/15/97	Sat 11/15/97
4	Cryostat Contract Award	Fri 7/24/98	Wed 8/5/98	Wed 8/5/98
5	Barrel FTs Final Design Review	Wed 9/30/98	Fri 10/2/98	Fri 10/2/98
6	Final Design Complete	Thu 12/31/98	Mon 12/7/98	Mon 12/7/98
7	FCAL Mech Design Complete	Mon 12/14/98	Wed 12/15/99	Wed 12/15/99
8	Start Module Construction	Sat 5/1/99	Mon 9/20/99	Mon 9/20/99
9	Select Final LVL2 Architecture	Fri 12/31/99	Fri 3/31/00	Fri 3/31/00
10	Start Elec.'s Production (Preamps)	Fri 6/30/00	Fri 6/30/00	Fri 6/30/00
11	Start MDT Chambers Lines 1 & 3	Mon 7/17/00	Fri 9/15/00	Fri 9/15/00
12	Kinematic Mount Design Complete	Tue 1/30/01	Tue 1/30/01	Tue 1/30/01
13	Start Production of MBs	Sun 4/1/01	Fri 3/30/01	Fri 3/30/01
14	Cryostat Arrives at CERN	Tue 5/15/01	Mon 7/2/01	NA
15	Select Final Elec Design	Fri 6/15/01	Wed 8/30/00	Wed 8/30/00
16	Start Full Silicon Strip Elec Production	Fri 7/6/01	Sun 7/15/01	NA
17	FEB SCA Prod Chip Submission/CA	Thu 7/19/01	Mon 10/1/01	NA
18	Pixels '1st IBM Prototype Submitted'	Thu 7/26/01	**Mon 9/17/01**	NA
19	Start CSC Chamber Production	Sat 9/1/01	Sat 9/1/01	NA
20	ROD Design Complete	Mon 10/1/01	Mon 10/1/01	NA
21	Level 1 Trigger Final Design Complete	Thu 10/4/01	Thu 10/4/01	NA
22	MDT Electronics ASD PRR	Fri 10/19/01	Fri 10/19/01	NA
23	Start Full Strip Module Production	Mon 1/7/02	Mon 1/7/02	NA
24	Start Production of ASICS	Fri 1/18/02	Fri 1/18/02	NA
25	Barrel FTs Production Complete	Fri 2/15/02	Fri 2/15/02	NA
26	Final Design of Global Align Devices	Mon 4/1/02	Mon 4/1/02	NA
27	CSC IC Production Complete	Wed 5/15/02	Wed 5/15/02	NA
28	MB System Production Complete	Sun 6/30/02	Sun 6/30/02	NA
29	LVL2 Trigger Prototype Complete	Mon 9/30/02	Mon 9/30/02	NA
30	Module Construction Complete	Mon 9/30/02	Mon 9/30/02	NA
31	All Elec.'s Components Delivered to ATLAS	Tue 10/1/02	Tue 10/1/02	NA
32	FCAL-C Delivered to EC	Thu 10/17/02	Thu 10/17/02	NA
33	All Modules Delivered to CERN	Mon 12/2/02	Mon 12/2/02	NA
34	ROD Final Design Complete	Thu 12/12/02	Thu 12/12/02	NA
35	LVL2 Trigger Design Complete	Tue 12/31/02	Tue 12/31/02	NA
36	Start Production	Wed 1/8/03	Wed 1/8/03	NA
37	Start Installation & Commissioning	Wed 3/5/03	Wed 3/5/03	NA
38	MDT Elec.'s Mezz Production Complete	Thu 3/6/03	Thu 3/6/03	NA
39	Pixels 'Start IBM Production'	Thu 3/13/03	Thu 3/13/03	NA
40	Module Production Complete (CUM 102)	Mon 3/31/03	Mon 3/31/03	NA
41	ROD Production/Testing Complete	Tue 6/24/03	Tue 6/24/03	NA
42	Barrel Construction Complete	Tue 9/16/03	Tue 9/16/03	NA
43	Compl Shipment of Silicon Strip Modules Prod	Mon 10/13/03	Mon 10/13/03	NA
44	Pixels 'Start IBM Outer Bare Module Prod'	Wed 10/22/03	Wed 10/22/03	NA
45	CSC ROD Production Complete	Wed 11/5/03	Wed 11/5/03	NA
46	FCAL-A Delivered to EC	Mon 12/8/03	Mon 12/8/03	NA
47	Kinematic Mount Production Complete	Mon 5/24/04	Mon 5/24/04	NA
48	MDT Chambers (U.S.) Prod Compl (Qty. 240)	Fri 8/27/04	Tue 9/14/04	NA
49	Global Align System Final Delivery	Thu 9/30/04	Thu 9/30/04	NA
50	Pixels 'Disk System at CERN'	Wed 10/13/04	Wed 10/13/04	NA
51	CSC Assembly/Test at CERN Complete	Fri 12/17/04	Fri 12/17/04	NA
52	Installation Complete	Tue 1/4/05	Tue 1/4/05	NA
53	Production Complete	Sat 7/30/05	Sat 7/30/05	NA
54	Installation & Commissioning Complete	Fri 9/30/05	Fri 9/30/05	NA

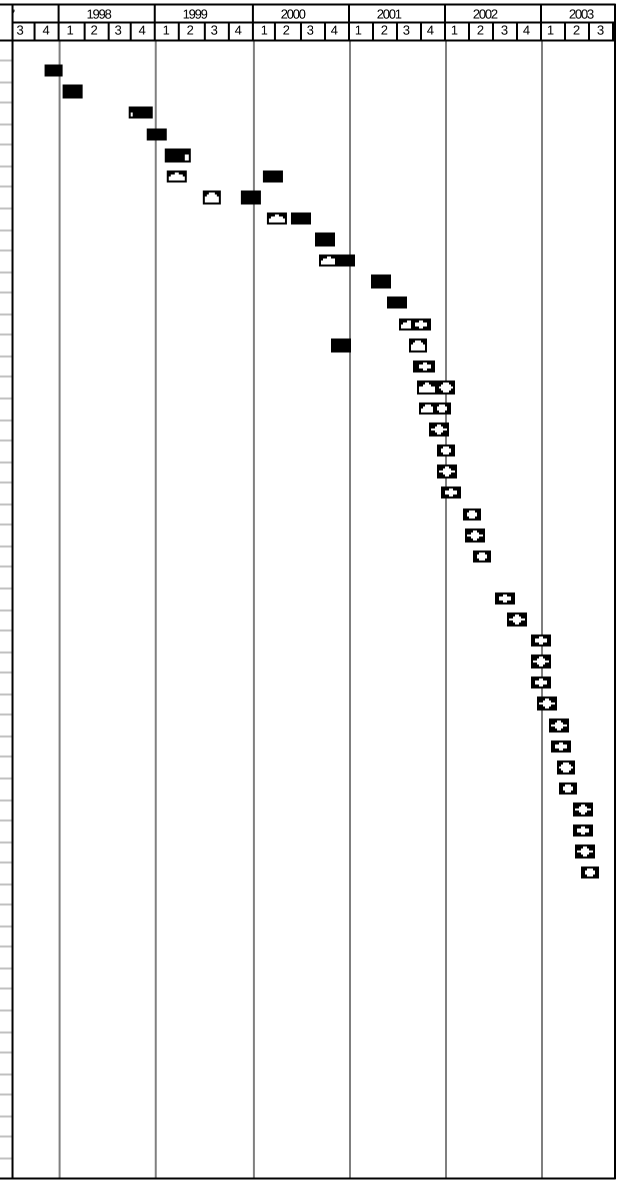
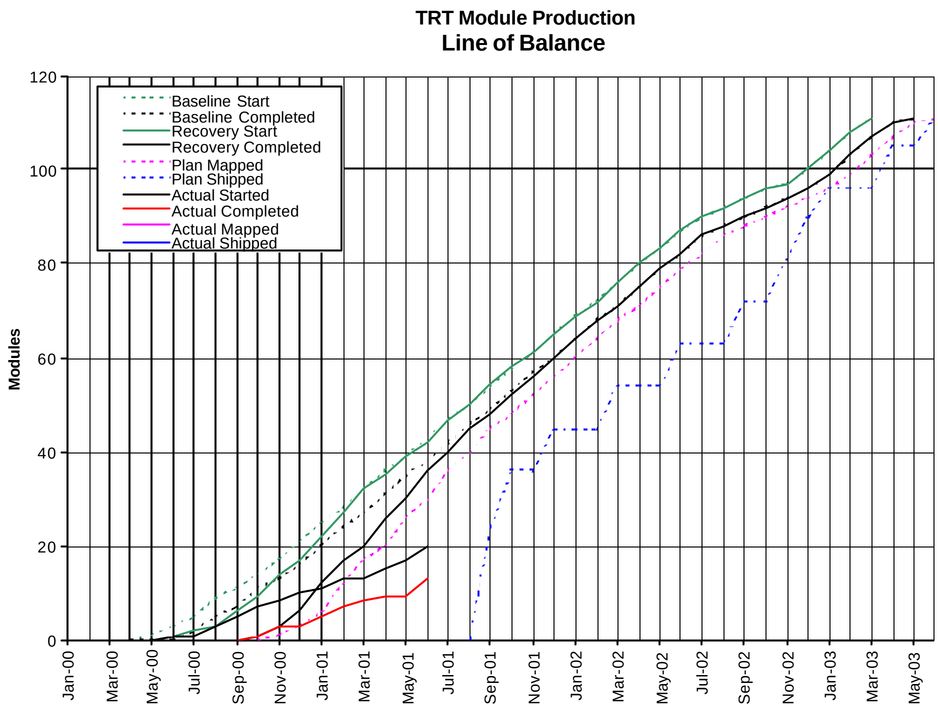
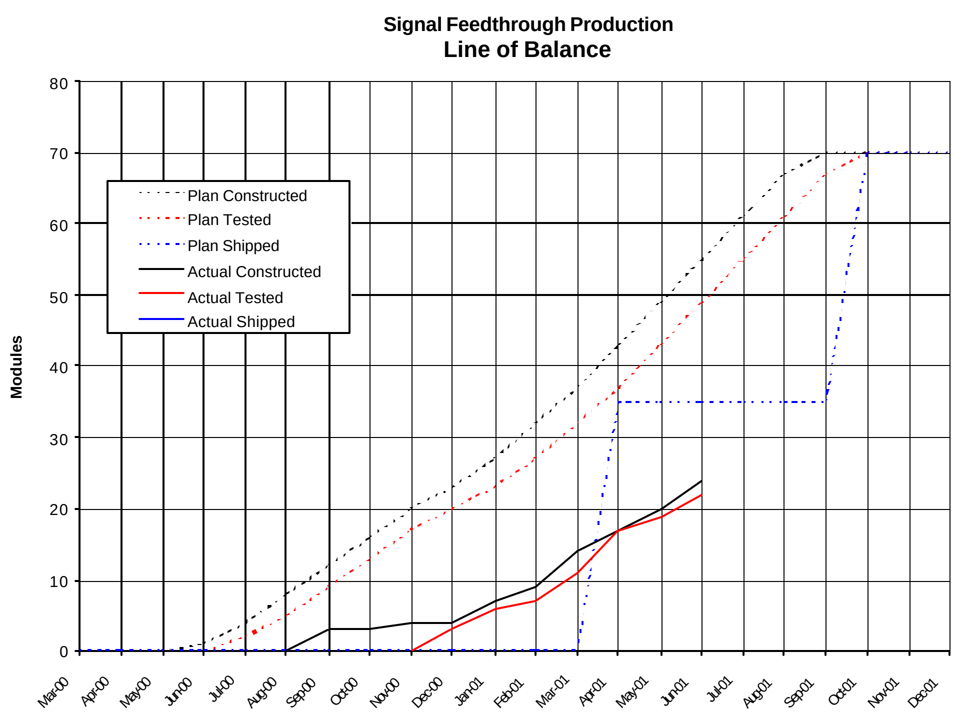


FIGURE 11-2 - LINE OF BALANCE THROUGH JUNE 2001





12. MILESTONE LOG

The milestones have been updated with the new ETC 01 baseline dates.

U.S. ATLAS Major Project Milestones (Level 1)

Description	Baseline Schedule	Forecast (F) Date	Actual (A) Date
Project Start	01-Oct-95	01-Oct-95 (F)	01-Oct-95 (A)
Project Completion	30-Sep-05	30-Sep-05 (F)	

U.S. ATLAS Major Project Milestones (Level 2)

Subsystem	**Schedule Designator**	**Description**	**Baseline Schedule**	**Forecast (F) / Actual (A) Date**
Silicon (1.1)	SIL L2/1	Start Full Silicon Strip Electronics Production	06-Jul-01	15-Jul-01 (F)
	SIL L2/2	Start Full Strip Module Production	07-Jan-02	07-Jan-02 (F)
	SIL L2/3	ROD Design Complete	01-Oct-01	01-Oct-01 (F)
	SIL L2/4	Complete Shipment of Silicon Strip Module Production	13-Oct-03	13-Oct-03 (F)
	SIL L2/5	ROD Production/Testing Complete	24-Jun-03	24-Jun-03 (F)
	SIL L2/6	Pixels 1st IBM Prototype Submitted	26-Jul-01	**17-Sep-01 (F)**
	SIL L2/7	Pixels Start IBM Production	13-Mar-03	13-Mar-03 (F)
	SIL L2/8	Pixels Start IBM Outer Bare Module Prod	22-Oct-03	22-Oct-03 (F)
	SIL L2/9	Pixels Disk System at CERN	13-Oct-04	13-Oct-04 (F)
TRT (1.2)				
Mechanical	TRT L2/1	Final Design Complete	31-Dec-98	07-Dec-98 (A)
	TRT L2/2	Module Production Complete (CUM 102)	31-Mar-03	31-Mar-03 (F)
	TRT L2/3	Barrel Construction Complete	16-Sep-03	16-Sep-03 (F)
Electrical	TRT L2/4	Select Final Elec Design	15-Jun-01	30-Aug-00 (A)
	TRT L2/5	Start Production of ASICS	18-Jan-02	18-Jan-02 (F)
	TRT L2/6	Installation Complete	04-Jan-05	04-Jan-05 (F)
LAr Cal (1.3)	LAr L2/1	Cryostat Contract Award	24-Jul-98	05-Aug-98 (A)
	LAr L2/2	Barrel Feedthroughs Final Design Review	30-Sep-98	02-Oct-98 (A)
	LAr L2/3	Start Electronics Production (Preamps)	30-Jun-00	30-Jun-00 (A)
	LAr L2/4	FCAL Mechanical Design Complete	14-Dec-98	15-Dec-99 (A)
	LAr L2/5	FEB SCA Prod. Chip Submission/Contract Award	19-Jul-01	01-Oct-01 (F)
	LAr L2/6	Level 1 Trigger Final Design Complete	04-Oct-01	04-Oct-01 (F)
	LAr L2/7	ROD Final Design Complete	12-Dec-02	12-Dec-02 (F)
	LAr L2/8	Motherboard System Production Complete	30-Jun-02	30-Jun-02 (F)
	LAr L2/9	Cryostat Arrives at CERN	15-May-01	02-Jul-01 (F)
	LAr L2/10	Barrel Feedthroughs Production Complete	15-Feb-02	15-Feb-02 (F)
	LAr L2/11	FCAL-C Delivered to EC	17-Oct-02	17-Oct-02 (F)
	LAr L2/12	FCAL-A Delivered to EC	08-Dec-03	08-Dec-03 (F)

Subsystem	Schedule Designator	Description	Baseline Schedule	Forecast (F) / Actual (A) Date

U.S. ATLAS Major Project Milestones (Level 2) (Continued)

Subsystem	Schedule Designator	Description	Baseline Schedule	Forecast (F) / Actual (A) Date
Tile Cal (1.4)	Tile L2/1	Start Submodule Procurement	01-Sep-97	01-Sep-97 (A)
	Tile L2/2	Technology Choice for F/E Electronics	15-Nov-97	15-Nov-97 (A)
	Tile L2/3	Start Module Construction	01-May-99	20-Sep-99 (A)
	Tile L2/4	Start Production of Motherboards	01-Apr-01	30-Mar-01 (A)
	Tile L2/5	All Electronic Components Delivered to CERN	01-Oct-02	01-Oct-02 (F)
	Tile L2/6	Module Construction Complete	30-Sept-02	30-Sep-02 (F)
	Tile L2/7	All Modules Delivered to CERN	02-Dec-02	02-Dec-02 (F)
Muon (1.5)	Muon L2/1	Start MDT Chambers Lines 1 and 3	17-Jul-00	15-Sep-00 (A)
	Muon L2/2	Start CSC Chamber Production	01-Sep-01	01-Sep-01 (F)
	Muon L2/3	MDT Electronics ASD PRR	19-Oct-01	01-Oct-01 (F)
	Muon L2/4	Final Design of Global Alignment Devices Complete	01-Apr-02	01-Apr-02 (F)
	Muon L2/5	CSC IC Production Complete	15-May-02	15-May-02 (F)
	Muon L2/6	Kinematic Mount Design Complete	30-Jan-01	30-Jan-01 (A)
	Muon L2/7	MDT Chambers (U.S.) Production Complete	27-Aug-04	14-Sep-04 (F)
	Muon L2/8	Kinematic Mount Production Complete	24-May-04	24-May-04 (F)
	Muon L2/9	CSC ROD Production Complete	05-Nov-03	05-Nov-03 (F)
	Muon L2/10	MDT Elec.’s Mezzanine Production Complete	06-Mar-03	06-Mar-03 (F)
	Muon L2/11	CSC Assembly/Testing at CERN Complete	17-Dec-04	17-Dec-04 (F)
	Muon L2/12	Global Alignment System Final Delivery	30-Sep-04	30-Sep-04 (F)
Trigger/ DAQ (1.6)	TDAQ L2/1	Select Final LVL2 Architecture	31-Dec-99	31-Mar-00 (A)
	TDAQ L2/2	LVL2 Trigger Design Complete	31-Dec-02	31-Dec-02 (F)
	TDAQ L2/3	LVL2 Trigger Prototype Complete	30-Sep-02	30-Sep-02 (F)
	TDAQ L2/4	Start Production	08-Jan-03	08-Jan-03 (F)
	TDAQ L2/5	Start Installation & Commissioning	05-Mar-03	05-Mar-03 (F)
	TDAQ L2/6	Production Complete	30-Jul-05	30-Jul-05 (F)
	TDAQ L2/7	LVL2 Installation & Commissioning Complete	30-Sep-05	30-Sep-05 (F)

U.S. ATLAS Major Project Milestones (Level 4)

WBS	Schedule Designator	U.S. ATLAS Responsibility Completion Description	ETC01 Baseline Scope Planned Completion Date	Forecast (F)/ Actual (A) Baseline Scope Completion Date	ATLAS Required Date	Baseline Scope Planned Float (Months)
Silicon						
1.1.2	Sil L4/1	Complete Shipping of Silicon Strip Prod Modules	10/03	10/03	4/03	-6
1.1.3	Sil L4/2	RODs 45% Production Complete	9/02	9/02	6/03	9
1.1.1	Sil L4/3	Pixels 'Disk System at CERN'	10/04	10/04	12/04	2
TRT						
1.2.1	TRT L4/1	Barrel Modules Ship to CERN Complete	8/02	8/02	3/03	7
1.2.5	TRT L4/2	ASDBLRs Ship to LUND Complete	10/02	10/02	11/02	1
	TRT L4/3	ASDBLRs Ship to CERN Complete	11/02	11/02	12/02	1
	TRT L4/4	PCB-Endcaps Ship to CERN Complete	4/03	4/03	10/03	6
LAr						
1.3.1	LAr L4/1	Cryostat Final Acceptance Test Complete	8/01	8/01	11/01	3
1.3.2	LAr L4/2	Signal FT Installation Complete	11/02	11/02	10/02	-1
	LAr L4/3	HV FT End-Cap C Install Complete	2/02	2/02	11/01	-3
	LAr L4/4	HV FT Barrel Install Complete	11/01	11/01	5/02	6
	LAr L4/5	HV FT End-Cap A Install Complete	12/02	12/02	9/02	-3
1.3.3	LAr L4/6	LAr Cryogenics Vendor Install Complete	9/03	9/03	12/03	3
1.3.4.1	LAr L4/7	Last Del of Readout Electrodes	12/02	12/02	10/02	-2
1.3.4.2	LAr L4/8	MBs Ship to Annecy,Saclay (France)	6/02	6/02	9/02	3
1.3.5.1	LAr L4/9	Preamp Deliveries to FEB Complete	5/03	5/03	3/04	10
1.3.5.2	LAr L4/10	Prec Calor Calib Production Complete	N/A	N/A	N/A	N/A

U.S. ATLAS Major Project Milestones (Level 4) (Continued)

WBS	Schedule Designator	U.S. ATLAS Responsibility Completion Description	ETC01 Baseline Scope Planned Completion Date	Forecast (F)/ Actual (A) Baseline Scope Completion Date	ATLAS Required Date	Baseline Scope Planned Float (Months)
Lar (Continued)						
1.3.6.1	LAr L4/12	Pedestal Ship to CERN Complete	12/01	12/01	7/02	7
	LAr L4/13	Barrel Ship to CERN Complete	12/01	12/01	3/03	15
1.3.6.2	LAr L4/14	Cables Shipping Complete	10/02	10/02	3/03	5
	LAr L4/15	Baseplane Last Delivery to CERN Complete	10/02	10/02	3/03	5
1.3.6.3	LAr L4/16	EC Crates Last Delivery to CERN Complete	10/02	10/02	3/03	5
	LAr L4/17	Barrel Crates Last Delivery to CERN Complete	10/02	10/02	3/03	5
1.3.6.4	LAr L4/18	Controls Ship to CERN Complete	9/03	9/03	5/04	8
	LAr L4/19	Power Supplies Last Delivery Complete	9/04	9/04	5/04	-4
1.3.6.5	LAr L4/21	Thermal Contacts (Proto) Last Delivery Complete	9/02	9/02	9/02	0
1.3.7.1	LAr L4/22	FEB Last Delivery Complete	8/04	8/04	1/05	5
1.3.7.2	LAr L4/23	SCAs Last Delivery to FEB Complete	N/A	N/A	N/A	N/A
1.3.7.4	LAr L4/24	Last Driver Delivery to FEB Complete	4/04	4/04	5/04	1
1.3.8.1	LAr L4/26	Layer Sums Last Delivery to FEB Complete	12/02	12/02	3/04	15
1.3.8.2	LAr L4/27	I/F to Level 1 Ship to CERN Complete	8/04	8/04	12/04	4
1.3.9	LAr L4/28	ROD System Final Prototype Complete	8/02	8/02	8/02	0
1.3.10	LAr L4/29	Deliver Finished FCAL-C to EC	10/02	10/02	10/02	0
	LAr L4/30	Deliver Finished FCAL-A to EC	12/03	12/03	11/03	-1
	LAr L4/31	FCAL Elec.'s Summ Bds Ready for Installation	12/01	12/01	2/02	2
	LAr L4/32	FCAL Elec.'s Cold Cables Testing Complete	11/01	11/01	2/02	3

U.S. ATLAS Major Project Milestones (Level 4) (Continued)

WBS	Schedule Designator	U.S. ATLAS Responsibility Completion Description	ETC01 Baseline Scope Planned Completion Date	Forecast (F)/ Actual (A) Baseline Scope Completion Date	ATLAS Required Date	Baseline Scope Planned Float (Months)
Tile						
1.4.1	Tile L4/1	Submodules Production Complete	7/01	7/01	8/01	1
	Tile L4/2	EB Module Ship to CERN Complete	12/01	12/01	7/02	7
1.4.2	Tile L4/3	Optics Instrumentation at ANL & MSU Complete	9/02	9/02	11/02	2
1.4.3	Tile L4/4	PMT Ship to ATLAS Complete	1/02	1/02	7/02	6
1.4.3	Tile L4/5	Readout Ship to ATLAS Complete	6/02	6/02	9/02	3
1.4.4	Tile L4/6	Gap Submodules Ship to ANL & BCN Complete	7/01	7/01	8/01	1
Muon						
1.5.7 (1)	Muon L4/1	MDT Chamber Prod Complete (BMC Qty. 80)	6/04	6/04	2/04	-4
		MDT Chamber Prod Complete (Mich Qty. 80)	8/04	8/04	2/04	-6
		MDT Chamber Prod Complete (Seattle Qty. 80)	8/04	8/04	2/04	-6
1.5.8 (2)	Muon L4/2	MDT Mounts Prod Complete/Delivered to Chambers	10/03	10/03	2/04	4
1.5.9 (3)	Muon L4/3	MDT Elec.'s Mezzanine Bd Production Complete	3/03	3/03	2/03	-1
	Muon L4/4	MDT Elec.'s Hedgehog Production Complete	12/01	12/01	4/01	-8
1.5.4	Muon L4/5	CSC Chambers Production Complete	1/03	1/03	4/04	15
1.5.11 (5)	Muon L4/6	ASMs Production Complete	4/04	4/04	4/04	0
	Muon L4/7	Sparsifiers Ship to CERN	3/04	3/04	10/04	7
	Muon L4/8	RODs Ship to CERN	3/04	3/04	10/04	7
	Muon L4/9	Support Electronics Ship to CERN	3/04	3/04	10/04	7
1.5.12 (6)	Muon L4/10	Align Bars Ship to CERN	3/04	3/04	12/04	9
	Muon L4/11	Proximity Monitors Ship to CERN	12/03	12/03	12/04	12
	Muon L4/12	Multi-Point System Ship to CERN	3/03	3/03	3/05	24
	Muon L4/13	DAQ Ship to CERN	9/04	9/04	12/04	3

13. NSF COST SCHEDULE STATUS REPORT

Fourteen US ATLAS institutions will receive funding under the NSF Cooperative Agreement (No. PHY 9722537) in FY01. Technical progress reports are given in the respective subsystem paragraphs of Section 4. The NSF Cost Schedule Status Report (CSSR) in this section covers these 14 institutions, in addition to the Education, Institutional Dues and Common Project items which will be funded by the NSF, and also the Items Outside Approved Baseline and Contingency.

Status through the month of June 2001 reflects the new baseline schedules for all subsystems. The schedules are resource-loaded to the baseline funding of $163,750K with Contingency, Management Contingency and Items Outside of the Approved Baseline shown on separate lines, excluding all NSF R&D funds. The anticipated NSF contribution to the baseline funding is $60,800K

We note that more than half of the universities in the NSF CSSR are, or have been, funded by both NSF and DOE, while we manage the project without distinguishing the agency source of funding. For this reason, the NSF+DOE Budgeted AY$s column in Table 13-1 includes all Project funds allocated to each institution, while the last two columns to the far right show the contribution of each agency.

The re-baseline date was established as October 1 2000 and the FY 01 Estimate to Complete (ETC-01) was defined as all tasks and resources required too complete the project. These tasks were scheduled and the necessary resources were loaded into the schedules. All prior efforts were equated to the actual cost expended. There was a negative schedule variance along with a positive cost variance in the old baseline and this resulted in a reduction in both the work scheduled and the work performed in the new baseline.

The CSSR shows that $23,402.6K of the work has been completed which represents approximately 41.1% of the work authorized to date. There is an unfavorable schedule variance of $355.5 or 1.5% behind the plan and a favorable cost variance of $36.7K or 0.2% under spent for the work accomplished. There are outstanding commitments of $891.4k at this time that do not show up in the performance.

Schedule Variance

Hampton – SV = ($108.4k)

WBS 1.2.1.1.3 Barrel Module Component Assembly is behind plan $108.4k

University of Chicago – SV = ($95.0k)

WBS 1.4.3.3.3 Front End Mother Board Production is behind plan $89.7k

Cost Variance

Although the overall cost variance for NSF Institutions is a favorable $36.7k it is comprised of both positive and negative variances as follows:

- Brandeis – CV = ($135.1k)
  - Overspent on tooling ($39.8k)
  - Charging against Global System Production tasks ($92.7k)

- Nevis – CV = ($110.3K)
  - Over spent on the FEB
- MSU CV = ($92.4K)
  - Over spent on Trigger/DAQ Level 2 SRB
- University of Rochester CV = $503.7K
  - Under spent by $349.8k on Vendor Manufacturing but shows an outstanding commitment of $317.8k
  - Under spent by $161.4k on Manufacturing Monitoring
- University of Texas Arlington CV = ($97.7K)
  - Over spent by $47.8k on the Intermediate Tile Calorimeter Production
  - Reported $60k of prior year cost
- University of Chicago CV = $80.9K
  - Under spent by $117.7k on Readout
  - Overspent by $33k Extended Barrel Module

Table 13

Cost Schedule Status Report

Reporting Period Ending:6/30/01

	Cumulative To Date (k$)					At Completion (k$)			Complete (%)				
	Budgeted Cost		Actual Cost	Variance		NSF + DOE	Latest					Budgeted AY $s	
	Work	Work	Of Work			Budgeted	Revised					NSF	DOE
Institution	Scheduled	Performed	Performed	Schedule	Cost	AY $s	Estimate	Variance	Scheduled	Performed	Actual		
Brandeis	1,816.2	1,810.7	1,945.8	(5.5)	(135.1)	2,848.5	2,848.5	-	63.8	63.6	68.3	2,413.3	435.2
Harvard	2,780.6	2,780.6	2,843.1	-	(62.5)	6,909.4	6,909.4	-	40.2	40.2	41.1	6,909.4	
Columbia Nevis Lab [2]	3,479.5	3,478.1	3,588.4	(1.4)	(110.3)	9,458.1	9,458.1	-	36.8	36.8	37.9	9,196.8	261.3
Hampton University	987.3	878.9	887.2	(108.4)	(8.3)	1,495.3	1,495.3	-	66.0	58.8	59.3	1,495.3	
Michigan State University	582.2	553.6	646.0	(28.6)	(92.4)	1,075.5	1,075.5	-	54.1	51.5	60.1	1,040.2	35.3
Oklahoma	131.1	131.1	136.1	-	(5.0)	393.7	393.7	-	33.3	33.3	34.6	342.3	51.4
Pittsburg	511.7	511.7	540.4	-	(28.7)	2,033.6	2,033.6	-	25.2	25.2	26.6	1,920.1	113.5
SUNY Stony Brook	470.3	470.3	505.0	-	(34.7)	1,089.1	1,089.1	-	43.2	43.2	46.4	1,083.9	5.2
University of California Irvine	629.1	580.1	573.3	(49.0)	6.8	2,010.4	2,010.4	-	31.3	28.9	28.5	1,715.8	294.6
University of California Santa Cruz	3,294.0	3,282.8	3,234.6	(11.2)	48.2	3,984.5	3,984.5	-	82.7	82.4	81.2	3,286.3	698.2
University of Rochester	4,973.3	4,940.7	4,437.0	(32.6)	503.7	9,287.6	9,287.6	-	53.5	53.2	47.8	8,936.7	350.9
University of Texas Arlington	915.9	908.7	1,006.4	(7.2)	(97.7)	1,534.7	1,534.7	-	59.7	59.2	65.6	1,431.0	103.7
University of Chicago	1,976.8	1,881.8	1,800.9	(95.0)	80.9	2,126.9	2,126.9	-	92.9	88.5	84.7	2,115.4	11.5
Washington	1,210.1	1,193.5	1,221.9	(16.6)	(28.4)	3,241.0	3,241.0	-	37.3	36.8	37.7	3,241.0	
Education [3]				-	-	286.5	286.5	-	-	-	-	286.5	
Institutional Dues [3]				-	-	2,036.6	2,036.6	-	-	-	-	1,930.4	106.2
Common Projects [3]				-	-	7,142.5	7,142.5	-	-	-	-	652.2	6,490.3
Sub Total	23,758.1	23,402.6	23,365.9	(355.5)	36.7	56,953.9	56,953.9	-	41.7	41.1	41.0	47,996.6	
								-				-	
Items outside baseline						2,388.5	2,388.5	-				2,388.5	
Management Contingency						4,921.7	4,921.7	-				4,921.7	
Contingency						4,219.9	4,219.9	-				4,219.9	
Project Management						1,273.3	1,273.3	-				1,273.3	
							-						
Total (with DOE Funds included)	23,758.1	23,402.6	23,365.9	(355.5)	36.7	69,757.3	69,757.3	-	34.1	33.5	33.5		8,957.3
Total NSF Funds												60,800.0	
Note 1. Not used												60,800.0	69,757.30
2. Nevis Costs do not currently include Project management costs												-	

14. DETAILED TECHNICAL PROGRESS

1.1 SILICON

Milestones with changed forecast dates:

1.1.1.1.2 Development/Prototypes

Milestone	Baseline	Previous	Forecast	Status
Complete sector development	20-Jun-01	20-Jun-01	15-Jul-01	Delayed (See #1)

Note #1 Lack of irradiation source has caused delay. Will use commercial source.

1.1.1.2.1 Design

Milestone	Baseline	Previous	Forecast	Status
Compl. Spec for production order release	12-Mar-01	16-Jun-01	15-Sep-01	Delayed (See #1)
ATLAS PM approval of production procurement	23-Jul-01	23-Jul-01	1-Oct-01	Delayed (See #2)
Release initial MC for sensors/testing	23-Jul-01	23-Jul-01	1-Oct-01	Delayed (See #3)

Note #1-3 Production is planned to begin in January 2002. Since there is considerable slack in the sensor schedule, this has no impact on the global schedule.

1.1.1.3.2 Development/Prototypes

Milestone	Baseline	Previous	Forecast	Status
1st IBM prototype submitted (FE-I1)	26-Jul-01	26-Jul-01	17-Sep-01	Delayed (See #1)
1st IBM prototype delivered	24-Oct-01	24-Oct-01	12-Nov-01	Delayed (See #2)
Complete initial wafer probe FE-I1	7-Nov-01	7-Nov-01	26-Nov-01	Delayed (See #3)

Note #1 Testing of the Analog Test chip has revealed large threshold dispersion. This must be improved before full submission. Other accumulated delays suggest a total two-month delay in the submission date.
Note #2-3 See note #2 above. Note that due to reduced foundry demand, the turnaround for IBM has been observed to be as low as 5 weeks, so the 8-week processing time assumed here should be reasonable.

1.1.2.1.3 Production

Milestone	Baseline	Previous	Forecast	Status
Complete preproduction fab	28-Feb-01	30-Jun-01	30-Jul-01	Delayed (See #1)

Note #1 The last of the 5 pre-production lots was delivered with one out of spec fab parameter. We gave Atmel a conditional waiver in that we said we would first test the wafers and then determine to accept them only if the out of spec parameter did not effect yield or performance. Atmel has also delivered some extra wafers to augment the last lots which did yield poorly. We have not tested all the wafers and therefore have not accepted the last lot. The remaining wafers should be tested by end of July so that we can complete acceptance.

1.1.3.6.3 User Evaluation of ROD in Europe

Milestone	Baseline	Previous	Forecast	Status
SCT ATLAS Final Design Review	11-Jun-01	11-Aug-01	15-Nov-01	Delayed (See #1)
SCT ROD User Evaluation Complete	1-Oct-01	1-Oct-01	15-Apr-02	Delayed (See #2)

Note #1 The production model card are due to be fabricated and tested at LBL(3 ea.) by Oct. 10 2001. They will then be sent to Cambridge for testing to be completed by early November. The date for the review is predicated on the completion of the Cambridge test.

Note #2 The complete user evaluation is predicated in completion of the production model of the BOC and ROD. The prototype TIM will be used for the testing. The limiting factor is completion of the initial SCT DAQ. The SCT DAQ prototype is schedule to be completed in October of 2001 and the usable DAQ will be ready in January of 2002. The DAQ and cards will be used at CERN in December 2001 to early April 2002 to verify that the SCT Off Detector Electronics function as expected.

1.1.3.7.1 Updating of ROD to production Model

Milestone	Baseline	Previous	Forecast	Status
SCT ATLAS ROD PRR	1-Oct-01	1-Oct-01	15-Apr-02	Delayed (See #1)

Note #1 The PRR is contingent on completion of the user evaluation. Please see 1.1.3.6.3 SCT ROD user evaluation complete for details.

1.1.3.7.3 Evaluation of Production Model

Milestone	Baseline	Previous	Forecast	Status
Start Production Procurements	13-Apr-01	13-Jul-01	30-Jul-01	Delayed (See #1)
Release Production Dwg/Specs	16-May-01	25-Jul-01	15-Aug-01	Delayed (See #2)
Pixel ROD Design complete	14-Jun-01	1-Aug-01	15-Nov-01	Delayed (See #3)
Release Production Bids	4-Jul-01	4-Jul-01	20-Aug-01	Delayed (See #4)
Bid Evaluation Complete	15-Aug-01	15-Aug-01	7-Sep-01	Delayed (See #5)

Note #1 The procurement is for the incremental parts to complete the 5% production. The amount of the purchase is for 3 ROD boards of parts.

Note #2 The current progress show that the drawing will not be ready till 15 august of 2001. This was caused by the extended time required to debug the proto ROD. Production is not expected to slip past the macro assembly site need date.

Note #3 The production model is scheduled to be tested at LBL and Cambridge by November 15 2001.

Note #4 The first bid to be released is for the Production model and 5% production of PC cards (25 ea.). The large production bid will not be released till the user evaluation at CERN system test is complete.

These card are needed for the system test at CERN and evaluation of the ROD at the macro assembly sites.

Note #5 The delay will have no impact on needs.

1.1.3.8.1 ROD 5% Production

Milestone	Baseline	Previous	Forecast	Status
Project Managers Approval 5% Production	1-Oct-01	1-Oct-01	18-Jul-01	See Note #1
Begin First End Cap SCT Module Ass/Test	25-Nov-01	25-Nov-01	25-Feb-02	Delayed (See #2)

Note #1 The approval is needed to complete the parts order for the 5% production. The incremental parts are for 3 ROD cards.
Note #2 Projected by survey of the macro assembly sites.

1.1.1 Pixels **Murdock Gilchriese (Lawrence Berkeley Lab.)**

1.1.1.1 Mechanics

A Conceptual Design Review of the pixel mechanics, and a PRR or the local supports, will be held in July. Much of the month was spent finalizing designs and documentation for these reviews. In general, the mechanics work is proceeding on schedule with some minor delays. The most worrisome area is currently the coolant fittings for which a number of options exist but not yet a qualified baseline design for all aspects. This must be resolved in the next three months or it will delay sector production. Production materials for the disk sectors began to arrive in June and it's possible all materials will be delivered by July.

1.1.1.2 Sensors

All of the preproduction wafers from CIS have been delivered. The QC results on these wafers look good. The delivery from Tesla continues to be delayed. Because of four unscheduled one-week shutdowns at Tesla in the last 4 months, their May delivery deadline was missed. Presently all technological problems (e.g., ion implantation) seem to be solved.

The double-sided aligner was not functioning in June but was scheduled for rapid repair. Production lots are now in the line at Tesla again.

Negotiations are underway for a production start with CIS by January 2002.

1.1.1.3 Electronics

A design review of the IBM FE IC was completed in June. The completion of the design and submission of the first prototype FE chip is now projected to be delayed by about two months. In part this results from corrective actions to be taken to mitigate the large threshold dispersion seen in the Analog Test Chips (although this now appears to be understood), the loss of the IBM version of the ATC in the mail for almost one month and from underestimating the time necessary for final simulation and verification. Recent experience with IBM fabrication times indicate that it may be possible to only have a three week delay in delivery of the first engineering run even though the submission has been delayed.

1.1.1.4 Hybrids

The design and layout for the version 3 flex hybrid remains behind schedule primarily because of requests for additional features and to produce versions compatible with both the existing AMS MCC chip (v 3.x) and with the upcoming 0.25 micron version (v 4.x). Since the electronics schedule has also been delayed by about a month, delays in the hybrids are not yet affecting the overall schedule.

The Taiwan optical package was selected in a review in June. Ohio State will continue to develop the optical hybrid boards but using the Taiwan packages.

1.1.1.5 Modules

Thermal cycling tests of dummy modules on real (sector) structures has started. The first result on solder bumped modules is not encouraging, and thermal cycling (about 20 times over the maximum temperature range) induces breakage in the bump bonds. We do not yet understand this, and additional tests are underway, also with indium bumped modules.

Another partial batch of dummy 8" wafers is in progress to, hopefully, correct error made in the first batch.

1.1.1.1 Mechanics

1.1.1.1.1 Design

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
Cables/services CDR	20-Jun-01	--	11-Jul-01	Delayed (See #1)
Disk Sector PRR	20-Jun-01	--	12-Jul-01	Delayed (See #2)
Global Support CDR	20-Jun-01	--	11-Jul-01	Delayed (See #3)
Support tube CDR	20-Jun-01	--	11-Jul-01	Delayed (See #4)
Global Support FDR	16-Oct-01	--	16-Oct-01	On Schedule

Note #1-4 Unable to arrange reviewers with TC on original date.

Murdock Gilchriese (Lawrence Berkeley Lab.)

Disk Sectors

Design activity for disk sectors was focused on completing production models and drawings. These models and drawings will be used for tooling manufacture. They are also input to the PRR of the disk sectors to be held in July. Considerable time was spent completing the specifications, QC/QA documents and other documents needed for the PRR.

Disk Support Rings

A. Technical Specification was prepared for the disk rings and will be part of the documentation for the Conceptual Design Review (CDR) of the pixel mechanics to be held in July. Design of tooling for the manufacture of the production rings started. A detailed cost estimate for the producing a preproduction ring was started in preparation for placing a contract for production.

Global Support Frame

The analysis of the global support frame continued. Detailed calculations were done on the vibrational response of the frame and of deflections under different load conditions. These calculations were documented in a note in preparations for the CDR. A Technical Specification for the global support was prepared for the CDR.

PP2/cable project (for M. Hoeferkamp)

A new iteration of the PP2 connector layout was done based on further cable optimization and a change in the location of Patch Panel 2 to outside of the muon chamber. The Type II cables now are made up of 4 standard cable designs, the length increased from 3 to 9 meters, and the voltage drop across this section of cables is now 1 volt. PP2 has one connector per cable for a total of 50 connectors. These, when laid out on the 150mm x 450mm side panel, fit with a spacing of 4mm between the connector shells. There is a concern about whether the connectors can be mated and demated when placed so closely together, so prototyping of this layout is being done. M. Hoeferkamp is searching for a smaller connector that is suitable for this application.

1.1.1.1.2 Development/Prototypes

Milestone	Baseline	Previous	Forecast	Status
Complete sector development	20-Jun-01	20-Jun-01	15-Jul-01	Delayed (See #1)
Complete disk development	16-Oct-01	--	16-Oct-01	On Schedule
Complete global support development/prototypes	16-Oct-01	--	16-Oct-01	On Schedule

Note #1 Lack of irradiation source has caused delay. Will use commercial source.

Neal Hartman (Lawrence Berkeley Lab.)

INSTALLATION MOCKUP

Work has begun on a friction-testing machine that will evaluate the dynamic friction of potential slider materials for the frame and service panels. Normal load and sliding speed will both be variable. Potential sliding materials that are now being considered are: polyimide (trade name Vespel), PEEK, and PPS (polyphenylsulfide - trade name Ryton). Samples of these materials with different fillers (primarily moly-disulfide) have been ordered and should arrive by early next month.

COOLING SERVICES

Primarily, work has centered on preparing for next month's sector PRR. Testing has continued on variseal fitting samples, but results have not yet been tabulated. New taper seal fittings (Luer-Lok type) have been fabricated in both aluminum and PEEK, and initial bubble tests in alcohol look promising (cold and warm). Complete testing of the taper seal fittings will continue next month, following the prescribed testing regimen.

Murdock Gilchriese (Lawrence Berkeley Lab.)

Disk Sectors

The pre-radiation thermal qualification of the latest sector prototypes was completed. The latest prototypes easily meet specifications. Preparations were made to irradiate the prototypes in early July.

Disk Support Rings and Global Support Frame

The trial insertion of the 2nd prototype support ring into the prototype end-section of the global support frame was completed. Measurements were made of the deflection of the ring under different loads. The measured deflections are in good agreement with previous measurements of deflection of the ring outside the support frame, which implies little deflection in the mounts. The agreement with FEA calculations is at the level of 30%, the measured deflections being less than the FEA predictions.

1.1.1.1.3 Production — Murdock Gilchriese (Lawrence Berkeley Lab.)

Disk Sectors

The production order of aluminum tubes was delivered at the end of June. Bending trials and other qualification tests will begin in July. The production order for the reticulated vitreous carbon foam was delivered. The density was about 10% over specification but otherwise is OK. The order was accepted. Heat treatment of the carbon-carbon panels was completed. The density of the panels is 1.70-1.75 gm/cc, within specification. Test specimens were cut for tensile and thermal conductivity measurements. Rectangular panels were cut from one plate and sent to LBNL for inspection just at the end of June.

Disk Support Rings

Our plan is to proceed with a contract for fabrication of one pre-production ring in July. Vendor negotiations were started.

1.1.1.2 Sensors

1.1.1.2.1 Design

Milestone	Baseline	Previous	Forecast	Status
Compl. Spec for production order release	12-Mar-01	16-Jun-01	15-Sep-01	Delayed (See #1)
ATLAS PM approval of production procurement	23-Jul-01	23-Jul-01	1-Oct-01	Delayed (See #2)
Release initial MC for sensors/testing	23-Jul-01	23-Jul-01	1-Oct-01	Delayed (See #3)

Note #1-3 Production is planned to begin in January 2002. Since there is considerable slack in the sensor schedule, this has no impact on the global schedule.

1.1.1.2.3 Production **Murdock Gilchriese (Lawrence Berkeley Lab.)**

For S. Seidel

All CiS tiles have been delivered. One mislabeled wafer will be replaced. Production runs will begin in January for 400 tiles. CiS has prepared an offer to revise the conditions of the contract to require >35% 3-good-tile wafers. This will require some additional probing and bumping. The group agreed to accept this offer if no legal restrictions are encountered. Because of four unscheduled one-week shutdowns at Tesla in the last 4 months, their May delivery deadline was missed. Presently all technological problems (e.g., ion implantation) seem to be solved.

The double-sided aligner was not functioning in June but was scheduled for rapid repair. Production lots are now in the line at Tesla again.

Acceptance testing of preproduction wafers continued at all of the institutes. At New Mexico, this involved (1) repeating QA procedure 2, visual inspection, on the 12 remaining wafers (one wafer was used for cross calibration and is circulating among the probing institutes); (2) performing QA procedure 4, IV on diode with guardring, on both diodes of all 12 wafers; (3) repeating QA procedure 6, IV on tile (qty=3), single chip (qty=6) and minichip (qty=2), on each of the 12 wafers. (4) In addition results of QA procedures 7 (IV on oxide test structure), 8 (CV on oxide test structure), and 9 (IVgate on gate controlled diode) were compiled and calculations of oxide capacitance, flatband capacitance, flatband voltage, and oxide current were presented at the June sensor meeting at CERN; (5) furthermore, a preliminary run of QA procedure 11, I-t on tile, was performed at all of the institutes. (6) All of the probing groups compiled statistics on the amount of time taken to perform the various acceptance tests and presented the results at the June sensor meeting. The estimate of measurement time is 8 hrs/wafer including setup.

In general CiS wafers meet their IV requirements. The quality of these wafers seems correlated with production run number. Depletion voltages are consistent with about 65V. IV's measured on the diode structure are all below 16 nA. Current is very stable versus time. In general the TESLA devices show higher leakage current, higher oxide current, and higher flatband voltage than do the CiS wafers. For the TESLA wafers, breakdown voltages are between about 270 and 350 V. Depletion voltages are 75 - 80V. Their current, which while high, meets ATLAS requirements, is adequately stable with time. Of the CiS single chips, about 78% are good; of the mini-chips, about 86% are good. Of the TESLA single chips, about 25% are good; of the mini-chips, about 44% are good.

Installation of the double-sided probing chuck has required significant effort at all of the probing institutes and is still underway at some. At Udine, IV measurements have now been made with both 1-side and 2-sided chucks. Without temperature correction, the measurements agree adequately for extraction of information needed for QA. Finalization of the planarity test procedure is in progress. Two analysis techniques have been compared and shown to give slightly different results---however the CiS wafers pass the planarity requirement in either case.

Saturation levels of oxide charge in irradiated p-spray devices have been studied for devices irradiated without gate bias by a 20 keV electron beam. For a variety of processes and vendors, saturation is observed below 50 kGy, and all instances show saturation levels below 3.5×10^{12} cm^{-2}. The saturation level is seen to be independent of electric field applied during irradiation and independent of dose rate. Studies of the surface recombination velocity show that it begins to saturate at 50 kGy but is not fully saturated by 500 kGy. Irradiation tests with a low dose p-spray MOSFET for a 560 kGy dose predict that interpixel isolation will be maintained at all dose levels for low and high dose p-spray.

Active irradiations at the PS include 4 mini-chips and 2 diodes at different fluences, four single chips in a coolant-contaminated atmosphere, and two single chips irradiated under 600 V bias. Devices now in preparation for irradiation include four sensors with glue and two indium-bumped single chips.

Studies have been made of pixel point resolution for clustering with digital and analog information, for sensor operation at a variety of bias voltages. Operation of the sensors at 300 V or more from the beginning of the run seems likely to improve detector resolution by 20% over the default value presently expected.

Cd and Am sources continue to be used to study the depletion voltage of irradiated sensors. With the modules in a cool box, a bias voltage scan is performed, and at each step, several measurements of the hitbus frequency are taken. The mean value of these measurements is plotted, yielding a function which rises linearly at low voltages and is flat at high voltages. Identification of the intersection point of the slopes of the two regions provides the depletion voltage. A systematic difference is evident for the Cd and Am tests. A Monte Carlo simulation will be made to examine this. A ToT study will also be done to verify the behavior of the devices at different stages in the depletion process.

1.1.1.3 Electronics

1.1.1.3.1 Design

Milestone	Baseline	Previous	Forecast	Status
FE-I1 spec complete	16-May-01	--	16-Jul-01	Delayed (See #1)
FE-I1 FDR	13-Jun-01	--	13-Jun-01	Completed

Note #1 Specification has been started, and was supposed to be ready for June review. Testing of Analog Test chip has taken priority.

Kevin Einsweiler (Lawrence Berkeley Lab.)

In our Feb meeting with ATMEL, they promised to process a new lot, using our FE-D2 masks, in which they would divide the lot between wafers in which the top epitaxial layer was deposited by their present US vendor, and wafers in which this layer was deposited by a second German vendor. Preliminary evidence from other designs indicated a significant yield improvement, and they suggested exploring this for pixels. We have received 12 wafers at LBL, and besides the split between the two epi vendors, there was also a split described as "standard/thin oxide", although rumor has it that the thin oxide processing mainly has extra cleaning steps. We have probed these 12 wafers and found no indications of any improvement in the FE-D2D yield. It remains at the few percent level for basic digital tests (which require working registers and nine working but not perfect column pairs). For the FE-D2S, the wafers with the so-called standard oxide processing had very poor yield, similar to that of the FE-D2D. The wafers from either epi vendor with the thin oxide processing had roughly the same FE-D2S yield as seen in the previous run (about 25%). We concluded that there was no indication of any trend towards acceptable yield for the

FE-D2D chips, and no improvement over the previous yield for the FE-D2S. This effectively terminates our activity with ATMEL.

We continue to place all of our design resources on the deep-submicron design effort. We received our TSMC Analog Test chip, submitted in March, in May. It has by now been fairly well characterized, using our new test system. The major problem remains the large observed threshold dispersion. This problem is somewhat confused by our lack of reliable knowledge of the values of the critical capacitors on the test chip. We need to know the value of the load capacitors (used to simulate detector capacitance for noise and timewalk measurements), and either one of the injection capacitors, or the feedback capacitor. A set of load capacitors were connected together in a large array on the test chip for measurement, but unfortunately they were not connected identically to those used in the pixel, so it is not possible to measure the capacitance at the relevant potential without cutting off some protection diodes (expensive FIB surgery). None of the other capacitors were connected into test arrays. Up to now, we have used a technique of measuring the feedback current and the rate of return to baseline for the preamp to extract a value for the feedback capacitor. After more careful comparisons between simulation and measurement, we have realized that the initial extraction accidentally had the expected value, but by doing the measurement with different values of injected charge, we can move the value by up to 30%. This makes it difficult to be sure of the scale of what we have measured so far. In earlier generations of analog test chips for HP and Honeywell, we had always placed arrays of the critical capacitors on chip for calibration purposes. In the rush to prepare these chips for the very aggressive submission dates, this very useful feature was dropped. Clearly, in the future we will always have capacitor arrays on our test chips.

Further detailed simulations of the threshold dispersion, including expected VT variations for all devices in the front-end have led to a predicted dispersion for the TSMC front-end of slightly more than 2000e, quite similar to the measured values. However, as stated above, we should now place some 20-30% uncertainty on this agreement, due to our poor knowledge of the feedback and injection capacitors.

We were also expecting to receive the IBM version of the analog test chip in early June. Unfortunately due to a combination of absurd delays in CERN shipping, and serious errors by the shipping company, it took one month to send the IBM wafers for dicing and get them back, so we received the die only at the end of June. This meant that we had no IBM chips for our scheduled June 21 irradiation. As this was the last irradiation period at LBL until Sept, we decided to irradiate a second TSMC chip, after carrying out better characterizations, up to the highest dose we could get in one run. After 120MRad of ionizing radiation, our test board stopped working, and so we halted the irradiation. After the several days required for this board to cool off after the irradiation, it began to work again. The chip itself did not significantly change its performance during this high-dose irradiation.

After receiving the IBM die, we have spent the last week carefully measuring 5 packaged chips. If we assume the nominal values for the feedback and injection capacitors, then the performance is improved over that observed with the TSMC test chip. The threshold and noise performance is about 160e noise and 1600e dispersion. Some modest improvement was expected, but what is observed is somewhat better than we expected. The major difference is the thickness of oxide layers changes some critical capacitor values. However, in the IBM case, we find larger inconsistencies between measurements and simulations when trying to extract the value of the feedback capacitor using the preamp return to baseline. We have tried a more complex method of extracting the feedback capacitor, and this also shows inconsistencies between measurement and simulation. For the time being, we can only assume the nominal capacitance values with large uncertainties (the foundry specifies a 30% uncertainty in the inter-metal oxide thickness). In all other respects, the IBM die behaves in the same way as the TSMC die, and appears to have excellent performance. Due to its extremely tardy arrival, we do not have any opportunity to irradiate these die prior to submitting the engineering run.

We will continue studying the performance of the IBM die in detail to establish a list of any small changes or optimizations which should be made on the final version. We have also been studying what modifications could appropriately be made to the present design to reduce its threshold dispersion. The most obvious possibility would be to increase the present preamplifier gain somewhat. Comparing to our previous front-end designs, we have obtained dispersions which were about 5 times smaller, and used feedback capacitors which were also about 5 times smaller (meaning 5 times more gain). This suggests that, although there are things to optimize in the present design, its performance may not be so much worse than what we have built before, but because of the low preamp gain and the DC coupling throughout, the effects of any offsets after the preamp (in mV) are much larger when referred to the input (in electrons). We have decided for now to adopt a strategy in which we complete the layout of an FE-I which uses the identical front-end to that included in the analog test chips. Once this is complete, and undergoing verification, we will make a new version of the front-end with a factor 2 increase in preamp gain (basically by decreasing the feedback cap value by a factor 2). Our standard reticle contains two front-end chips, and as long as the modifications to the front-end design allow us to "drop in" the new version, we do not anticipate significant delay from this strategy. This seems to be the only strategy that will lead us to an engineering run on the timescale that the pixel project needs. Any major changes to the present design (I would argue that the change in preamp design is not a major change, although it is not so trivial to re-optimize things after the preamp either) would require a new testchip iteration. We believe the performance of the present IBM front-end is good enough that if we could get close to a factor two reduction in threshold dispersion, it would be an excellent first chip.

Meanwhile, work is continuing on all aspects of the complete FE-I chip. The entire design team went to CERN for a 2-day review at CERN in early June. Our work had not advanced to the level intended at the time the review was scheduled. However, we presented the detailed status of all of the work on the chip, including the remaining work and the verification strategy. There was quite some useful discussion at the review, and we came away with a number of suggestions and comments. The review, plus our test chip evaluation effort for both TSMC and IBM, have slowed down the main activity of integrating the complex chip. The integration of the chip is progressing well, but more slowly than expected. The analog integration has not progressed much in the last month, but it is almost complete. We have decided to integrate significant "smart" decoupling into the column pairs, in order to better manage the power distribution in the chip (we are very worried about the large transient currents that are generated in the 0.25u process when the large annular NMOS switch). These capacitors now have an internal monitoring circuit which is constantly checking for anomalous current drawn over long timescales. If this circuit detects an oxide fault at the level of about 1Kohm, it will automatically disconnect the capacitor from ground so that no current flows. Each capacitor is about 1.5pF, and fits in about 30x40 μm^2 of area, conveniently inside a pixel. The digital integration has been going smoothly. The layout of the column pair and the EOC buffers and their related logic is now complete. Extensive simulations are starting using TimeMill (an accelerated timing and power simulator that works from SPICE netlists and BSIM models, which being several orders of magnitude faster than SPICE), and Verilog. We intend to use TimeMill at the column pair level as our timing simulation, cross-checked on smaller netlists using ELDO SPICE. We are using Verilog for the overall functional verification, and have developed some simple code to check for the operation of all of the registers, etc.

In summary, very significant progress has been made towards a submission of the complete pixel array to IBM. We have now established a new target date for the submission, and are having very focused weekly meetings to be sure that we progress properly towards this goal. The new date is the middle of Sept, and we regard this as a realistic date given our present rate of progress in integration.

In order to exercise the next generation of chips from ATMEL and IBM to the fullest extent possible, and in particular to develop the capability to label chips as "known good die", and be sure that this classification will remain true after exposure to the full radiation doses of ATLAS, we are developing an improved test system.

We received the first PLL boards, and loaded two of them this month. One has been undergoing preliminary testing. We have not been able to devote much effort to this because of the higher priority given to the 0.25 μm work. However, basic checking of the module has taken place. The power and clock distribution are working, and the VME interface is working. Further checking, which involves the real VHDL in the module, is just starting.

We have now completed the PICT schematics, and will have a review of them in mid-July (this is delayed from our previous planning by about 2 weeks). We will need to make some minor modifications to cope with what appears to be the final pinout for the FE chip. We have begun board layout. The layout of this mixed-signal board will be somewhat challenging, and could easily take a month. With our present complement of 1 FTE of engineering working on this design, it is progressing, but significantly more slowly than initially expected.

The accumulated delays in the PLL and PICT effort due to the relatively low quality of engineering manpower available show no sign of improving. The delivery of completed boards has slipped by more than 9 months compared to the initial planning, and there is no good technical reason for this. Due to their disappointing performance, the engineer who has been working on the PICT design is being transferred out of the board design group. This is an appropriate move to prevent future problems of the type encountered here, but leaves the present effort in very bad shape. In order to put this effort back on track, it will be necessary to divert some of the high-quality engineering from the ROD effort (now successfully completing its first system test) to the pixel test system effort for several months. This should allow us to complete the effort and have several fully debugged systems available on the timescale of October, as required for the returning FE-I wafers. This should have been done earlier, but the higher priority given to the ROD, and the reluctance of adding another higher-quality board-level engineer to the local group has prevented this solution. The schedule pressure has now reached the stage where something major must be done.

K K Gan (Ohio State)

We have designed a test board for the new IBM DORIC and VDC. The DORIC and VDC are now joined together because of limited dice space due to cost consideration. We decided to build a new board rather than use the old one which tests the DORIC and VDC separately and hence a dice must be wire bonded to test either DORIC or VDC. This new board allows us to use both VDC and DORIC on the same dice and conserves the limited supply of dice. The board has been tested with a package that contains both DORIC-D2 and VDC-D2. We are now ready for the delivery of the IBM dice which are expected in early June.

We have received the irradiated VDC and DORIC. The VDC is working properly. This is the VDC that received the least radiation and died near the end of the irradiation. For comparison, one of the Wuppertal VDCs is dead and the other VDC needs to be operated at 3.8 V and reset has no impact on the operation.

For the OSU DORICs, one is observed to have no change in PIN current threshold (71 uA) for no bit errors. This is the chip that produced bit errors immediately after installation. The other DORIC's PIN current threshold increased from 76 uA to 330 uA after irradiation. After 4 hours of annealing at room temperature, the threshold further decreased to 210 uA after the dice was reset. For the DORICs at Siegen, the monitoring diffusion resistors have been measured. The values increased by 10% as predicted but the bias currents decreased by 20-40% instead of the expected 10%, indicating other components in the bias circuit have changed. The threshold PIN currents for no bit errors have increased by a factor of 1.3-2.8.

The VDC/DORIC on the opto-board are currently being studied. Based on the above preliminary result, the radiation hardness of DMILL is deemed inadequate for the Pixel detector.

1.1.1.3.2 Development/Prototypes

Milestone	Baseline	Previous	Forecast	Status
FE-D3 submitted	2-May-01	--	2-Dec-01	Delayed (See #1)
1st IBM prototype submitted (FE-I1)	26-Jul-01	26-Jul-01	17-Sep-01	Delayed (See #2)
FE-D3 wafers arrive	22-Aug-01	--	22-Aug-01	Delayed (See #3)
1st IBM prototype delivered	24-Oct-01	24-Oct-01	12-Nov-01	Delayed (See #4)
Complete initial wafer probe FE-I1	7-Nov-01	7-Nov-01	26-Nov-01	Delayed (See #5)

Note #1, 3 We have delayed all further work on FE-D3 pending submission of FE-I1 and study of its performance. At the present time, no further DMILL submissions are foreseen unless significant problems are observed with 0.25u designs

Note #2, 5 Testing of the Analog Test chip has revealed large threshold dispersion. This must be improved before full submission. Other accumulated delays suggest a total two-month delay in the submission date.

Note #4 See note #2 above. Note that due to reduced foundry demand, the turnaround for IBM has been observed to be as low as 5 weeks, so the 8-week processing time assumed here should be reasonable.

1.1.1.4 Flex Hybrids/Optical Hybrids

1.1.1.4.1 Design

Milestone	Baseline	Previous	Forecast	Status
Optical package decision	15-Jun-01	--	15-Jun-01	Completed

Rusty Boyd (University of Oklahoma)

Flex Hybrid Design (UOK)

The design and layout for the version 3 flex hybrid remains behind schedule. Although outstanding issues such as the final pin out of the MCC and position of holes for pickup and handling of flex modules were resolved during the June Pixel week at CERN, other issues came up which required attention. Specifically, the electronics coordinator requested information on the maximum capacitance of the LVDS and CMOS signal lines on the flex hybrid in order to assure that the drivers for the MCC and FE were adequate. This turned out to be a non-trivial task, as the signal lines can capacitively couple through the metallization on the sensor. This is difficult to simulate because of the scale required (1 micron of Al on the sensor with at least 10 cm line length to avoid domination of end effects in the capacitance solutions). In the end we agreed on a maximum value of 20 pF based on simulations and tests of v2 flex.

It was also decided during discussions at the Pixel meetings to include more features for the flex hybrid. Specifically, we are adding wire bond pads for the flex hybrid signal lines and power lines in one corner to the test pigtail at the end of the flex hybrid. This allows monitoring of these signals and the power supply voltages during test of the flex hybrid before and after attachment to the module. Also, since termination resistors are not included in the pad frame for the MCC and FE, they are still being included in the v4 layout, with the understanding that they need to be included in the MCC and FE for the final version.

The ETA for delivery of the v3 layout for fabrication is now mid-July, after a design review and any required changes. This is still well ahead of the FE and MCC submission schedules, which are now set for September.

1.1.1.4.2 Development/Prototypes **Rusty Boyd (University of Oklahoma)**

Flex Hybrid Development (UOK)

We have begun development of the flex hybrid test system at UOK and Albany. Albany, with the assistance of LBL, has made significant progress on high voltage testing (see the next section). Although Genoa has been working on a flex test system for about 1 year, it was obvious from their presentations at the module meeting during the June Pixel week that it is a system that can not be easily replicated at other sites and is better suited to testing the MCC than flex hybrids. We are presently developing a system based on a combination of passive tests and active tests. The active tests use the PixelDAQ system, developed by LBL, in conjunction with a probe card with an FE, to insure that the MCC can communicate with any of the 16 FE's, once mounted on a module. The equipment used is already available or under development at each of the flex hybrid test sites (UOK, Genoa and Albany).

K K Gan (Ohio State)

There was a review of the OSU and Taiwan opto-packs in June. Both designs meet the specifications. The Taiwan opto-pack has ~10-15% higher coupled power and was chosen as the baseline in order to take advantage of the additional resource from Taiwan.

The new opto-board has been received and populated with DORICs/VDCs and opto-packs. No design errors were found. The PIN threshold currents of the six DORICs are ~40-60 uA for no bit errors. Based on the experience of the previous opto-board, we expect a few DORICs to have thresholds of ~20 uA. Investigation of the signal at the pre-amp outputs reveal that most of the pre-amps have low input offsets, confirming this expectation. We believe the high thresholds are due to the large separation between the DORICs and the PINs on the Pixel opto-packs. This design was driven by the large physical size of the DORICs, incomparable with the opto-pack which contains several PIN in close proximity.

1.1.1.5 Modules

1.1.1.5.2 Development/Prototypes Maurice Garcia-Sciveres (Lawrence Berkeley Lab.)

LBL Module Assembly Status Report for June 28, 2001

Dummy-Dummy modules

One module loaded on backside of sector. Three on front side. SO far all tooling and procedures work as designed.

Dummy Modules

One IZM dummy module was mounted on a sector with CGL and thermal-cycled from room temperature to -35 deg. C 19 times. No open columns were observed during cycling. However, after overnight storage at room temperature, several columns were measured to be open. All open columns are at either end of a chip, but chips with open columns are evenly distributed on the module.

Hot Modules

A third flex V2 module has been assembled using a CERN flex with MCC pre-loaded at Mipot and tested at Genova, and an IZM bare module. This third hot module has not yet been wirebonded.

Dummy wafers

Nitride passivation cannot be removed from first lot of 25 wafers. A new run of 10 wafers is in progress at Process Specialties using PETEOS oxide passivation, which will be done in-house and therefore comes with a stronger warranty than the nitride. This run is expected some time in July. More wafers can be ordered if the run is successful.

Wafer Thinning

After two failed tests it was determined that double-sided UV release tape cannot be used to temporarily hold bumped wafers on glass handle wafers. A low melting point water-soluble wax is currently being investigated.

Micro Welding

An Orthodyne Model 20 thick wire ultrasonic bonding machine has been ordered. It is expected to arrive at LBNL in late August or September. This would be used for disk pigtail and type 0 cable connections, and possibly for type I cables between PP0 and PP1.

1.1.2 Silicon Strip System — Abe Seiden (University Of Calif. At Santa Cruz)

Work continued on the module construction system at LBL and the wafer screening for the front-end chips at UCSC. Approximately 10 wafers have been thoroughly tested at UCSC. In addition 2 wafers have been circulated and tested on all three production-testing systems. The agreement between testers is at greater than 99% level. Comparisons have also been made with the old CERN tester which was used for all the old wafer screens. The agreement was also very good, although a little hard to evaluate since the recent test vectors used do not precisely overlap the old test vectors. Comparisons of the analog characteristics measured also show excellent correlation between testers and reproducibility. With the completion of this work along with recent radiation measurements on the chips the SCT groups are ready for the chip PRR and are ready for production.

The module program now has 15 barrel modules in the system test at CERN. These are performing very well lending support to the grounding and shielding scheme used as well the good functionality of the hybrids and chips. Noise in the system test does not show any increase over the noise levels seen for one individual module. Noise levels for irradiated modules have now been measured and are around 1800 to 1900 electrons (compared to about 1400 to 1500 electrons for unirradiated modules). This is a good result.

1.1.2.1 IC Electronics

1.1.2.1.1 Design

Milestone	Baseline	Previous	Forecast	Status
Production Readiness Review (PRR)	15-Jun-01	--	4-Jul-01	Delayed (See #1)

Note #1 The PRR has been delayed until 4-Jul to further understand one last post-rad problem we are having with some chips. SCT is moving forward with the PRR on this date. Preparations are underway.

Alexander A. Grillo (University Of Calif. At Santa Cruz)

LBNL & UCSC

The wafer tester hardware continued to run smoothly all month. The UCSC probe station has been having trouble with position errors. This has been a low-level issue for some time but the frequency has started to increase which makes unattended wafer testing problematic. The problem is being worked on but the cause is not yet understood. Tester software is now the biggest headache. The nominal person responsible at Valencia has been helping but his level of involvement is not sufficient. The collaborator at CERN has made many improvements in the software but is overworked being the only one at CERN presently working on wafer screening. The CERN person will also leave at the end of July and be replaced by less experienced people. Software maintenance is a big issue and we must find someone to take on that responsibility.

Qualification of the three new testers at CERN, RAL and UCSC proceeded well this month. At least 2 wafers have been tested on all four systems: original CERN tester, new LBNL tester at CERN and at RAL and at UCSC. Three more wafers have been tested on all but the RAL system. Correlation studies indicate the final perfect yield on all four systems varies by < 1%! The analog results (e.g. noise, gain, and offset) also agree very closely with the three new systems reporting less noise than the old CERN system. The digital tests still show some disagreements when compared test by test and this needs to be investigated and corrected.

There is still some more test engineering to complete. Some of the test vectors need to be combined for execution efficiency; the number of iterations of each test must be reduced in order to reduce test time while still maintaining acceptable reproducibility; and the new tests of the I/O timing and signal amplitudes must be added.

1.1.2.1.2 Development/Prototypes

Milestone	Baseline	Previous	Forecast	Status
Test Systems Complete	3-Aug-01	--	3-Aug-01	On Schedule

Alexander A. Grillo (University Of Calif. At Santa Cruz)

LBNL & UCSC

Only a small number of the remaining pre-production wafers were tested this month. Most effort was spent on cross-correlating the three wafer test systems and preparation for the ABCD Production Readiness Review.

1.1.2.1.3 Production

Milestone	Baseline	Previous	Forecast	Status
Complete preproduction fab	28-Feb-01	30-Jun-01	30-Jul-01	Delayed (See #1)
Complete preproduction design verification	23-May-01	--	30-Jun-01	Completed
Release/Start Full Electronics Production	6-Jul-01	--	15-Jul-01	Delayed (See #2)
First Lots Delivered	23-Nov-01	--	23-Nov-01	On Schedule

Note #1 The last of the 5 pre-production lots was delivered with one out of spec fab parameter. We gave Atmel a conditional waiver in that we said we would first test the wafers and then determine to accept them only if the out of spec parameter did not effect yield or performance. Atmel has also delivered some extra wafers to augment the last lots which did yield poorly. We have not tested all the wafers and therefore have not accepted the last lot. The remaining wafers should be tested by end of July so that we can complete acceptance.

Note #2 See note on delay of PRR to 4-Jul. If the PRR on 4-Jul is passed, we should start production by mid-July.

Alexander A. Grillo (University Of Calif. At Santa Cruz)

LBNL & UCSC

Much effort was spent preparing documents for the Production Readiness Review to be held 4-July. Negotiations were also held with ATMEL to arrive at a satisfactory method to handle wafer costs if the yield does not meet the minimum guarantee specified in the Frame Contract. A proposal was made to ATMEL to scale the wafer costs according to the ratio of the actual yield to 26%. It was offered that the yield would be averaged over the first 520 wafers rather than lot-by-lot to give ATMEL incentive to improve the yield quickly and thereby make-up for some low yield and low cost wafers at the beginning of production. After the first 520 wafers the yield would be averaged for each lot for purposes of calculating actual price.

Late breaking news: the ABCD PRR got a passing grade on 4-July and ATMEL accepted our proposal for scaling the wafer cost according to measured yield.

1.1.2.2 Hybrids/Cables/Fanouts

1.1.2.2.1 Design

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
Start Procurement for Production Hybrid Assembly	5-Mar-01	--	15-Jun-01	Completed
Release Hybrid Bids	30-Apr-01	--	15-Jun-01	Completed
Hybrid Bid Evaluation Complete	11-Jun-01	--	15-Jul-01	Delayed (See #1)
ATLAS PM Approval of Maj Procs	20-Aug-01	--	20-Aug-01	On Schedule
Hybrid/Module Production Readiness Review	3-Sep-01	--	3-Sep-01	On Schedule
Complete Award Hybrid Contracts	14-Sep-01	--	14-Sep-01	On Schedule

Note #1 Not a US responsibility, date reflects date of hybrid FDR now completed.

Carl Haber (Lawrence Berkeley Lab.)

This is no longer a US responsibility. The report of the FDR review committee which met in May is included in item 1.1.2.3.1

1.1.2.2.2 Development & Prototype Fabrication — Carl Haber (Lawrence Berkeley Lab.)

The hybrid folding fixture prototype was completed. It was partially tested. Plans were reviewed for modifications to make a production version of this fixture. Additional dummy hybrids were fabricated. Work continues on the temperature cycling test. A new holder was prepared to improve heat transfer.

1.1.2.2.3 Production

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
1st Preproduction Hybrids Avail for Mod Assy	4-Jun-01	--	15-Sep-01	Delayed (See #1)
Compl Preproduction Assy	13-Aug-01	--	21-Oct-01	Delayed (See #2)
Compl Testing of Preprod Hybrid	3-Sep-01	--	21-Oct-01	Delayed (See #3)

Note #1 This will follow the hybrid design review and is set by Japanese procurement schedule. The FDR is complete but some minor mods have been circulated.

Note #2-3 Set by date of item1 above.

1.1.2.3 Module Assembly and Test

1.1.2.3.1 Design of Assembly & Test Tooling

Milestone	Baseline	Previous	Forecast	Status
Compl Design of Preprod Mod Assy/Test	3-Sep-01	--	3-Sep-01	On Schedule
Module PRR	3-Sep-01	--	3-Sep-01	On Schedule

Carl Haber (Lawrence Berkeley Lab.)

Drawings of the new hybrid folder were revised. Discussions continued concerning the module fixation point.

1.1.2.3.2 Development & Prototypes

Carl Haber (Lawrence Berkeley Lab.)

The probe station and associated hardware/software for detector measurements was ordered and received. All components except a proper dark box are now in hand and a student has been assigned to write the control and daq code for this system.

Following the RAL visit additional measurements were made on our assembly tools and they were validates. A first mechanical module was fully assembled with this system. With software mods and adjustments to the imaging system applied after the RAL meetings the full-automated assembly ran successfully. This mechanical module is now being studied for metrology. The new metrology fixture was partially commissioned. The problem of measuring a 1.8 mm hole under high magnification was partially addressed with Smart Scope features.

A set of 12 dummy detectors from the UCB lab were received and sent for dicing.

A new mask was received for additional dummy detectors to be fabricated commercially.

1.1.2.3.3 Production

Milestone	Baseline	Previous	Forecast	Status
Complete Preproduction Module Assembly	30-Jul-01	--	30-Oct-01	Delayed (See #1)
Complete Preproduction Module Testing	3-Sep-01	--	30-Oct-01	Delayed (See #2)

Note #1-2 Require pre-production hybrids which won't be available until the end of summer.

Carl Haber (Lawrence Berkeley Lab.)

The report of the FDR committee from May was received and reproduced below.

SCT Barrel Modules FDR

Comments and Recommendation 24 & 25. May.2001.

The reviewers were impressed by the high quality of the technical documentation presented by the SCT team. For the reviewers this fact made comprehension of the difficult matter very much easier.

Most of these documents one would expect to see for a PRR rather then for a FDR. The status of the SCT module project shown through the presented papers and talks would have rather justified a PRR. The comments below, which are not going into deep technical details, should also be interpreted as proof of maturity of the SCT module project.

Through the coherent documentation several positive statements can be made: there seems to be consistency across clusters, the rework rates are encouragingly low, the costs (as far as known) seem to be well under control.

The most significant recommendation the reviewers could give to the SCT team is to go into production phase as fast as possible (for the PRR "green light" see also next point). The early production shall be used to get more statistics on all the processes, test out all assembly tooling and test facilities and refine them where needed. Also the sequence and the still open rejection criteria for some values should be defined during that phase.

To meet the request of the SCT team for the green light for component procurement, it is proposed to add some information and actions to the presented documents, to be handed in to ATLAS management, at dates to be agreed on:

All production and interface documents, including drawings on CDD, shall go through an EDMS approval process. Their final status, approved and released for the series production, should become visible.

Define nominally all persons in charge of production items and assembly as well as QC responsible for each cluster.

Establish full list with quantities of all items to be produced including allowances for losses through all assembly stages.

Give a detailed schedule of for baseboard components and hybrids indicating the start of pre-series, start of series production, 50% production done and the end of delivery

Establish a detailed schedule and sequence for the delivery and distribution of components to each cluster

The SCT hybrid team should provide all details of planned minor changes.

Statement on funding responsibilities

Assure that all four clusters not only work to the same standards throughout the series production period, but also have all necessary comprehensive documentation and manuals. This also ensures better protection against possible manpower fluctuations.

For the subsequent module assembly define the nature, required steps and criteria for the site reviews, freeze the dates.

Confirm by some more metrology on the modules that clearance between the modules is not any more an issue.

Cross-calibrate all QA points across clusters during production on regular basis

It was noted that information was missing on the actual status and availability of the SCT module database.

Provide specification on drilled holes and slots in baseboard to barrel project engineer

1.1.3 ROD Design & Fabrication Dick Jared (Lawrence Berkeley Lab.)

ROD Report June 2001

The Cambridge system test has started. Initial test results are very favorable. The following tests have been performed.

1. Communications with the Back Of Crate (BOC) has been tested. The crate controller via the ROD can write to all registers. These registers control DACs, configuration and delays. The delays and DAC outputs have been verified to agree with the set values. There is a timing problem with read. Some programming of the BOC PLA and the ROD timing is needed to correct the read problem. These are minor problems that will be easily corrected.

2. Communication with the TIM has been tested. The crate controller can load a set of values to the trigger pattern memory that is played to the ROD. The ROD receives the trigger data from the TIM and properly processes it.

3. Test stand software issued primitive (primitives are command or values to be read or written) that exercised the ROD and BOC. No problems with the software were found. These tests were for single primitives and lists of primitives.

4. Test stand software primitives lists were executed that configured the ROD and BOC. Other primitives lists were run that performed BOC delay and discriminator threshold scans and trapped the data in the ROD input memories. The test stand read the data and placed in files for analysis.

5. The high point of the tests was when simulated data was place in the SLOG (module out put data) and TIM (level 1 trigger data). This data was played out of the pattern memories of the SLOG and TIM. The SLOG bits streams (6 ea.) were converted to optical and sent to the BOC. The BOC converted the data to electronic signals and passed it on the ROD. In parallel the TIM generated trigger data and presented it to the ROD. The ROD processed the inputs data through the formatter and event fragment builder and saved the data in the event fragment builder output memories. This demonstrated that the ROD can process input data. There were some minor problems with the format of the data that are easily corrected.

These test that are ongoing showed that the 3 cards that are part of the data path worked correctly and that the interfaces are correct. The existing system at Cambridge will be used as a system for testing or upgrades of the hardware and a platform to develop the DAQ software for module macro assembly sites.

Currently the ROD is being upgraded to the production model and minor problems with the data path are being addressed. The controller FPGA (last FPGA that has untested functionality) is being tested and refined.

1.1.3.4 ROD Test Stand

1.1.3.4.3 SCT/Pixel Test Stand Software

Milestone	Baseline	Previous	Forecast	Status
Production Diagnostic Test Stand Completed	29-Sep-00	--	29-Aug-01	Delayed (See #1)

Note #1 The test stand software is completely functional for the production testing. This software will be updated for more efficiency in the next few months. The remaining testing is of the hardware (fabricated) to loop back the outputs to the FIFOs at the input to the ROD. The loop back cards are used to verify the output data quality. These loop back cards will be tested when more RODs are fabricated.

1.1.3.6 ROD Prototype Evaluation

1.1.3.6.1 SCT Prototype Testing

Milestone	Baseline	Previous	Forecast	Status
SCT Complete ROD Proto Testing	7-Jun-01	--	7-Jun-01	Completed

1.1.3.6.3 User Evaluation of ROD in Europe

Milestone	Baseline	Previous	Forecast	Status
SCT ATLAS Final Design Review	11-Jun-01	11-Aug-01	15-Nov-01	Delayed (See #1)
SCT ROD User Evaluation Complete	1-Oct-01	1-Oct-01	15-Apr-02	Delayed (See #2)

Note #1 The production model card are due to be fabricated and tested at LBL(3 ea.) by Oct. 10 2001. They will then be sent to Cambridge for testing to be completed by early November. The date for the review is predicated on the completion of the Cambridge test.

Note #2 The complete user evaluation is predicated in completion of the production model of the BOC and ROD. The prototype TIM will be used for the testing. The limiting factor is completion of the initial SCT DAQ. The SCT DAQ prototype is schedule to be completed in October of 2001 and the usable DAQ will be ready in January of 2002. The DAQ and cards will be used at CERN in December 2001 to early April 2002 to verify that the SCT Off Detector Electronics function as expected.

1.1.3.7 ROD Production Model

1.1.3.7.1 Updating of ROD to production Model

Milestone	Baselin e	Previous	Forecast	Status
SCT ATLAS ROD PRR	1-Oct-01	1-Oct-01	15-Apr-02	Delayed (See #1)

Note #1 The PRR is contingent on completion of the user evaluation. Please see 1.1.3.6.3 SCT ROD user evaluation complete for details.

1.1.3.7.3 Evaluation of Production Model

Milestone	Baseline	Previous	Forecast	Status
Start Production Procurements	13-Apr-01	13-Jul-01	30-Jul-01	Delayed (See #1)
Release Production Dwg/Specs	16-May-01	25-Jul-01	15-Aug-01	Delayed (See #2)
Pixel ROD Design complete	14-Jun-01	1-Aug-01	15-Nov-01	Delayed (See #3)
Release Production Bids	4-Jul-01	4-Jul-01	20-Aug-01	Delayed (See #4)
Bid Evaluation Complete	15-Aug-01	15-Aug-01	7-Sep-01	Delayed (See #5)

Note #1 The procurement is for the incremental parts to complete the 5% production. The amount of the purchase is for 3 ROD boards of parts.

Note #2 The current progress show that the drawing will not be ready till 15 august of 2001. This was caused by the extended time required to debug the proto ROD. Production is not expected to slip past the macro assembly site need date.

Note #3 The production model is scheduled to be tested at LBL and Cambridge by November 15 2001.

Note #4 The first bid to be released is for the Production model and 5% production of PC cards (25 ea.). The large production bid will not be released till the user evaluation at CERN system test is complete. These cards are needed for the system test at CERN and evaluation of the ROD at the macro assembly sites.

Note #5 The delay will have no impact on needs.

1.1.3.8 ROD Fabrication

1.1.3.8.1 ROD 5% Production

Milestone	Baseline	Previous	Forecast	Status

Project Managers Approval 5% Production	1-Oct-01	1-Oct-01	18-Jul-01	See Note #1
Begin First End Cap SCT Module Ass/Test	25-Nov-01	25-Nov-01	25-Feb-02	Delayed (See #2)

Note #1 The approval is needed to complete the parts order for the 5% production. The incremental parts are for 3 ROD cards.

Note #2 Projected by survey of the macro assembly sites.

1.2 TRT

Milestones with changed forecast dates:

1.2.1.1.3 Production

Milestone	Baseline	Previous	Forecast	Status
HV Plates (Module #3) CUM #5 Available	28-Feb-01	28-Jun-01	28-Aug-01	Delayed (See #1)
Module Assy #1 IU Module Assy CUM #4 Complete	28-Feb-01	28-Jul-01	28-Jun-01	Completed
Shells (Module #3) CUM #9 Available	28-Feb-01	28-Jun-01	28-Jul-01	Delayed (See #2)
CUM #23,343 Available from CERN	28-Feb-01	28-May-01	28-Aug-01	Delayed (See #3)
CUM #14,097 Available from Hampton	30-Apr-01	30-Jul-01	30-Jun-01	Completed
Module Assy #1 IU Module Assy CUM #7 Complete	30-Apr-01	30-Jun-01	30-Aug-01	Delayed (See #4)
HV Plates (Module #3) CUM #12 Available	31-May-01	31-Jul-01	31-Oct-01	Delayed (See #5)
HV Plates (Module #2) CUM #15 Available	31-May-01	31-Jul-01	1-Sep-01	Delayed (See #6)
HV Plates (Module #1) CUM #16 Available	31-May-01	31-Jul-01	1-Sep-01	Delayed (See #7)
Module Assy #2 Duke Module Assy CUM #11 Complete	29-Jun-01	29-Jun-01	29-Sep-01	Delayed (See #8)
CUM #37 Kit Available	29-Jun-01	29-Jun-01	29-Jun-02	Delayed (See #9)
HV Plates (Module #1) CUM #17 Available	29-Jun-01	29-Jun-01	29-Aug-01	Delayed (See #10)
HV Plates (Module #2) CUM #17 Available	29-Jun-01	29-Jun-01	29-Aug-01	Delayed (See #11)
Module Assy #1 IU Module Assy CUM #11 Complete	29-Jun-01	29-Jun-01	29-Sep-01	Delayed (See #12)
Shells (Module #1) CUM #17 Available	29-Jun-01	29-Jun-01	29-Aug-01	Delayed (See #13)
Shells (Module #2) CUM #17 Available	29-Jun-01	29-Jun-01	29-Aug-01	Delayed (See #14)
Shells (Module #3) CUM #13 Available	29-Jun-01	29-Jun-01	29-Sep-01	Delayed (See #15)

HV Plates (Module #3) CUM #13 Available	29-Jun-01	29-Jul-01	29-Oct-01	Delayed (See #16)
CUM #18,200 Available from Hampton	30-Jun-01	30-Jun-01	30-Jul-01	Delayed (See #17)
CUM #25,643 Available from CERN	30-Jun-01	30-Jun-01	30-Aug-01	Delayed (See #18)

Note #1 Waiting on HV plates
Note #2 Vision has started an accelerated production. We expect to catch up soon, but this has not been a hold up.
Note #3 Straws have been shipped but are held up at CERN.
Note #4 Delayed due to late HV plate and production pause.
Note #5 Delayed due to HV 3 plates
Note #6-7 Delayed due to pause.
Note #8, 10-11, 13- 15, 17-18 Delayed.
Note #9 Kits will follow HV plates.
Note #12 Delayed due to pause and parts.
Note #16 HV plates delayed.

1.2.5.1.2 Prototype

Milestone	Baseline	Previous	Forecast	Status
ASDBLR Design Frozen	13-Jul-01	13-Jul-01	13-Aug-01	Delayed (See #1)

Note #1 We hope we are on schedule here, the wafer processing problems at TEMIC may cause a delay in getting certifiably good chips from the run submitted in mid January and could cause this date to slip. Nevertheless, the preliminary tests on the "not good" wafers look so good that we are really only looking for statistical verification - otherwise the revised design looks to be in excellent shape and we expect to be able to freeze it.

1.2.1 Barrel Mechanics

1.2.1.1 Barrel Module — Ken McFarlane (Hampton University)

Production continued to keep up with module assembly. Details below.

1.2.1.1.3 Production

Milestone	Baseline	Previous	Forecast	Status
HV Plates (Module #3) CUM #3 Available	31-Jan-01	--	30-Jun-01	Completed
CUM #18 Kit Available	28-Feb-01	--	1-Jun-01	Completed
CUM #23,343 Available from CERN	28-Feb-01	28-May-01	28-Aug-01	Delayed (See #1)
HV Plates (Module #1) CUM #8 Available	28-Feb-01	--	28-Jun-01	Completed

HV Plates (Module #2) CUM #8 Available	28-Feb-01	--	28-Jun-01	Completed
HV Plates (Module #3) CUM #5 Available	28-Feb-01	28-Jun-01	28-Aug-01	Delayed (See #2)
Module Assy #1 IU Module Assy CUM #4 Complete	28-Feb-01	28-Jul-01	28-Jun-01	Completed
Shells (Module #3) CUM #9 Available	28-Feb-01	28-Jun-01	28-Jul-01	Delayed (See #3)
CUM #12,000 Available from Hampton	30-Mar-01	--	30-Jun-01	Completed
HV Plates (Module #1) CUM #12 Available	30-Mar-01	--	30-Jul-01	Delayed (See #4)
HV Plates (Module #2) CUM #12 Available	30-Mar-01	--	30-Jul-01	Delayed (See #5)
HV Plates (Module #3) CUM #9 Available	30-Mar-01	--	30-Sep-01	Delayed (See #6)
Module Assy #1 IU Module Assy CUM #5 Complete	30-Mar-01	--	30-Jun-01	Completed
Module Assy #3 Duke & IU Module Assy CUM #2 Complete	30-Mar-01	--	30-Jun-01	Completed
CUM #14,097 Available from Hampton	30-Apr-01	30-Jul-01	30-Jun-01	Completed
CUM #27 Kit Available	30-Apr-01	--	30-Sep-01	Delayed (See #7)
CUM #5 Test Complete	30-Apr-01	--	30-Sep-01	Delayed (See #8)
HV Plates (Module #1) CUM #14 Available	30-Apr-01	--	30-Jul-01	Delayed (See #9)
HV Plates (Module #2) CUM #14 Available	30-Apr-01	--	30-Jul-01	Delayed (See #10)
HV Plates (Module #3) CUM #11 Available	30-Apr-01	--	30-Sep-01	Delayed (See #11)
Module Assy #1 IU Module Assy CUM #7 Complete	30-Apr-01	30-Jun-01	30-Aug-01	Delayed (See #12)
Module Assy #2 Duke Module Assy CUM #7 Complete	30-Apr-01	--	30-May-01	Completed
Module Assy #3 Duke & IU Module Assy CUM #3 Complete	30-Apr-01	--	30-Sep-01	Delayed (See #13)
CUM #16,000 Available from Hampton	31-May-01	--	1-Jun-01	Completed
CUM #32 Kit Available	31-May-01	--	1-Sep-01	Delayed (See #14)
CUM #9 Test Complete	31-May-01	--	1-Sep-01	Delayed (See #15)
HV Plates (Module #1) CUM #16 Available	31-May-01	31-Jul-01	1-Sep-01	Delayed (See #16)
HV Plates (Module #2) CUM #15 Available	31-May-01	31-Jul-01	1-Sep-01	Delayed (See #17)

HV Plates (Module #3) CUM #12 Available	31-May-01	31-Jul-01	31-Oct-01	Delayed (See #18)
Module Assy #1 IU Module Assy CUM #9 Complete	31-May-01	--	1-Sep-01	Delayed (See #19)
Module Assy #2 Duke Module Assy CUM #9 Complete	31-May-01	--	31-Jul-01	Delayed (See #20)
Module Assy #3 Duke & IU Module Assy CUM #4 Complete	31-May-01	--	1-Sep-01	Delayed (See #21)
Shells (Module #1) CUM #16 Available	31-May-01	--	31-Jul-01	Delayed (See #22)
Shells (Module #2) CUM #15 Available	31-May-01	--	31-Jul-01	Delayed (See #23)
Shells (Module #3) CUM #12 Available	31-May-01	--	31-Jul-01	Delayed (See #24)
Wire Joints -2 CUM #13 (200/m) Available	28-Jun-01	--	28-Jun-01	Completed
CUM #37 Kit Available	29-Jun-01	29-Jun-01	29-Jun-02	Delayed (See #25)
HV Plates (Module #1) CUM #17 Available	29-Jun-01	29-Jun-01	29-Aug-01	Delayed (See #26)
HV Plates (Module #2) CUM #17 Available	29-Jun-01	29-Jun-01	29-Aug-01	Delayed (See #27)
HV Plates (Module #3) CUM #13 Available	29-Jun-01	29-Jul-01	29-Oct-01	Delayed (See #28)
Module Assy #1 IU Module Assy CUM #11 Complete	29-Jun-01	29-Jun-01	29-Sep-01	Delayed (See #29)
Module Assy #2 Duke Module Assy CUM #11 Complete	29-Jun-01	29-Jun-01	29-Sep-01	Delayed (See #30)
Module Assy #3 Duke & IU Module Assy CUM #6 Complete	29-Jun-01	--	29-Sep-01	Delayed (See #31)
Shells (Module #1) CUM #17 Available	29-Jun-01	29-Jun-01	29-Aug-01	Delayed (See #32)
Shells (Module #2) CUM #17 Available	29-Jun-01	29-Jun-01	29-Aug-01	Delayed (See #33)
Shells (Module #3) CUM #13 Available	29-Jun-01	29-Jun-01	29-Sep-01	Delayed (See #34)
Wire Joints -1 CUM #32 (600/m) Available	29-Jun-01	--	29-Jun-01	Completed
CUM #18,200 Available from Hampton	30-Jun-01	30-Jun-01	30-Jul-01	Delayed (See #35)
CUM #25,643 Available from CERN	30-Jun-01	30-Jun-01	30-Aug-01	Delayed (See #36)
Mangement Contingency Go-Ahead	2-Jul-01	--	2-Jul-01	On Schedule
CUM #20,665 Available from Hampton	31-Jul-01	--	31-Jul-01	On Schedule
CUM #27,943 Available from CERN	31-Jul-01	--	31-Jul-01	On Schedule
CUM #42 Kit Available	31-Jul-01	--	31-Jul-01	On Schedule
HV Plates (Module #1) CUM #18 Available	31-Jul-01	--	31-Jul-01	On Schedule

HV Plates (Module #2) CUM #18 Available	31-Jul-01	--	31-Jul-01	On Schedule
HV Plates (Module #3) CUM #14 Available	31-Jul-01	--	31-Jul-01	On Schedule
Module Assy #1 IU Module Assy CUM #13 Complete	31-Jul-01	--	31-Jul-01	On Schedule
Module Assy #2 Duke Module Assy CUM #13 Complete	31-Jul-01	--	31-Jul-01	On Schedule
Module Assy #3 Duke & IU Module Assy CUM #8 Complete	31-Jul-01	--	31-Jul-01	On Schedule
Shells (Module #1) CUM #18 Available	31-Jul-01	--	31-Jul-01	On Schedule
Shells (Module #2) CUM #18 Available	31-Jul-01	--	31-Jul-01	On Schedule
Shells (Module #3) CUM #14 Available	31-Jul-01	--	31-Jul-01	On Schedule

Wire Joints -1 CUM #36 (600/m) Available	31-Jul-01	--	31-Jul-01	On Schedule
Wire Joints -2 CUM #15 (200/m) Available	31-Jul-01	--	31-Jul-01	On Schedule
CUM #1 Kit Available	31-Aug-01	--	31-Aug-01	On Schedule
CUM #23,000 Available from Hampton	31-Aug-01	--	31-Aug-01	On Schedule
CUM #30,243 Available from CERN	31-Aug-01	--	31-Aug-01	On Schedule
CUM #48 Kit Available	31-Aug-01	--	31-Aug-01	On Schedule
HV Plates (Module #1) CUM #20 Available	31-Aug-01	--	31-Aug-01	On Schedule
HV Plates (Module #2) CUM #19 Available	31-Aug-01	--	31-Aug-01	On Schedule
HV Plates (Module #3) CUM #15 Available	31-Aug-01	--	31-Aug-01	On Schedule
Module Assy #1 IU Module Assy CUM #15 Complete	31-Aug-01	--	31-Aug-01	On Schedule
Module Assy #2 Duke Module Assy CUM #15 Complete	31-Aug-01	--	31-Aug-01	On Schedule
Module Assy #3 Duke & IU Module Assy CUM #10 Complete	31-Aug-01	--	31-Aug-01	On Schedule
Shells (Module #1) CUM #20 Available	31-Aug-01	--	31-Aug-01	On Schedule
Shells (Module #2) CUM #19 Available	31-Aug-01	--	31-Aug-01	On Schedule
Shells (Module #3) CUM #15 Available	31-Aug-01	--	31-Aug-01	On Schedule
Wire Joints -1 CUM #40 (600/m) Available	31-Aug-01	--	31-Aug-01	On Schedule
Wire Joints -2 CUM #17 (200/m) Available	31-Aug-01	--	31-Aug-01	On Schedule

Note #1 Straws have been shipped but are held up at CERN.

Note #2 Waiting on HV plates.

Note #3 Vision has started an accelerated production. We expect to catch up soon, but this has not been a hold up.

Note #4 HV plates are not available for kits.

Note #5-6 In production, but not here yet.

Note #7 Successful shipment from Dubna.

Note #8 Testing at Hampton still not operational.

Note #9-10 American Circuits working on backlog of approved plates.

Note #11 HV plate 3 are delayed due to machining problems

Note #12 Delayed due to late HV plate and production pause

Note #13, 28, 31 Delayed due to hold up in HV plates

Note #14-17, 19-21 Delayed due to pause.

Note #18 Delayed due to HV 3 plates

Note #22-24 Shells are keeping up with production but are delayed wrt schedule.

Note #25 Kits will follow HV plates.

Note #26-27, 30, 32-36 Delayed.

Note #29 Delayed due to pause and parts.

Note #37 This appears to be out of sequence.

Ken McFarlane (Hampton University)

Staff

No change; we now have a total of 5 technicians (including the QA tech, who now does assembly work on tension plates and capacitor barrels).

1.2.1.1.3.1 Detector Elements

1.2.1.1.3.1.1 Straws

A shipment of straws has been requested, from JINR (Dubna)

1.2.1.1.3.1.1.2 End sockets (end plugs)

1.2.1.1.3.1.1.4.1 Twister

1.2.1.1.3.1.1.4.2 Twister

1.2.1.1.3.1.1.8.2 Wire bushing (eyelet)

1.2.1.1.3.1.1.8.3 Crimp pin (taper pin)

1.2.1.1.3.1.1.8.5, 6 Gas connections

All purchase orders or contracts for the above components have been placed, and deliveries are on schedule. Revised drawings for new gas connections were received.

1.2.1.1.3.4 Assembly

Straw subassemblies

2,174 straw subassemblies were completed, 3,448 shipped, leaving 1,364 in inventory.

Radiator packs

Three type-1, and two type-2, radiator pack kits were produced this month.

Dividers

Three type-1, and one type-2, divider kits were produced this month.

Wire supports

3,826 outer wire supports were assembled this month. 2,732 were shipped, leaving 1,094 in inventory.

Capacitor Barrels

Produced as needed for tension-plate processing.

Tension plates

These are now processed as needed to create HV plate/TP kits.

HV plate testing and assembly with tension plates

Two HV plate/TP kits were produced (One type-1, one type-2).

Capacitor Assembly

No activity this month. The final decision on capacitor type has not been made.

Harold Ogren (Indiana University)

Divider material: Completed

Radiator fiber punching

Radiator material of all types is almost complete at Breiner Co. There are only a few more shipments of type 3 required. We have spare material at Breiner and at Bloomington to handle extra requests.

Module production:

Module 1.01 Completed. Presently at Dubna, cooling after a radiation test. Indications so far are that no problems arose after approximately 20 LHC years of radiation.

Module 1.02 Completed. At Duke University for gain testing.

Module 1.03 Completed. Being prepared for shipment to Hampton University.

Module 1.04 Waiting for stringing.

Module 1.05 Construction complete- in testing phase.

Module 1.06 In stringing station.

Module 1.07 Stringing complete, testing.

Modules 1.08, 1.09, 1.10 are being assembled.

Module 3.01 has been strung, and is being tested.

1.2.1.2 Gas/Cooling **Ken McFarlane (Hampton University)**

Dr. Ketevi Assamagan continued work on a 'User Requirements' document for the TRT gas system. This document will specify to the CERN Detector Gas group what the TRT requires for the TRT gas system.

1.2.1.2.3 Production

Milestone	Baseline	Previous	Forecast	Status
Production Management Contingency Go-Ahead	2-Jul-01	--	2-Oct-01	Delayed (See #1)

Note #1 Next meeting will be in October.

Seog Oh (Duke University)

Micro Discharge test

As one of the action items from the steering group, we have performed the micro discharge test. This is to test a long term HV integrity of the plate. In this test, 3000 volts is applied to the HV plates and the frequency of micro discharge is recorded. Since we have performed the test and wrote a report, a detail is not given. In summary, the discharge frequency is less then 0.01 Hz at 3000 volts with the typical signal of about a few mili-volt. The study shows that there should not be any long-term HV problem with plates.

Gas Leak specification modification

One important measurement for module validation is the gas tightness. Because of the cost of Xenon gas, the specification for the leak rate is very tight. The module should lose Xenon gas no more than ~ 5 times of its volume per year, which corresponds to less than 0.1 cc/min/module leak rate. The original specification for the leakage was 0.1 mbar/bar/min. In this rate, the gas permeation through straw tubes could be an important factor.

It has been recognized that the specification was too stringent and need to be re-evaluated. The correct specification is important because the original spec is difficult to meet and we may end up wasting time to meet the specification. As one of the action items, it was requested that Duke does a systematic study to re-evaluate the gas specification. We are equipped for the task because we have a fixture to measure the absolute gas leak rate directly using a gas chromatograph.

We have completed the study and wrote a report. In summary, the leak specification is indeed too tight. We believe that we can relax the leak specification by at least a factor of five, from 0.1 mbar/bar/min to 0.5 mbar/bar/min. Another interesting measurement was the gas permeation rate. We measured for two gases, CO_2 and Xenon. The permeation rate of either gas is low enough not to change the ionization gas concentration in straws.

Wire Joint aging study

One of the recommendations from the PAR is to proceed with the wire-joint aging test immediately. It has been shown that silicon can cause aging. Because there is silicon in glass, and silicon can be etched out by the florin radicals (the chamber gas contains CF_4), the glass beads may promote aging. There are ~ 10 grams of glass beads in the entire barrel module. Although a preliminary study was performed a few years ago, a more systematic study was requested. We have finished the design and we are in the process of setting up the aging test. Because this will be a long-term test (~ year), we have designed a system requires minimal human intervention.

For the test, we are constructing a module (~110 cm long) with 12 straws. These straws will be under intense radiation using ten 10 mili-cure ^{90}SR sources. In this design, the computer wakes up every few hours and starts the DAQ process. It closes all the sources and takes the data using an ^{55}Fe source. The sign of aging would be the decrease of the mean ^{55}Fe peak value in the ADC distribution. An ^{55}Fe source is mounted on a slider attached to a stepping motor such that the source can be moved along the straw length. As the source moves along, data is taken every ~1 cm interval. To save electronics, 16 straw channels are multiplexed to a single electronic channel. We expect to finish the construction by September.

HV Plates

We are still in the process of understanding the type III problem. For some reason the plates attached to the front side of modules are meeting the specification while the ones in the back side do not. In order to isolate the problem, the vendor machined another 3 sets about half way (before the plates are flipped up for completing machining). It is the speculation that the reference points are lost in the process of flipping. We have received the plated and they will be measured at FNAL.

The status of the high voltage plates for type I and type II is good. Presently ~80% of plates have passed the “revised” specification. This should be the green light for producing the rest of the plates soon.

Module Construction Status

Module 2.08

This module passed the HV and first leak test and is about half way of stringing. We should finish the stringing in 1.5 week.

Module 2.09

The mechanical construction is started

Module 3.02

We have all the components and the mechanical construction should start within a week.

Wire-joint production

The wire-joint production is moving well. Both stations are producing high quality wire-joints.

The number of joints produced is above LOB requirement.

1.2.1.3 Installation

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
Installation Management Contingency Go-Ahead	2-Jul-01	--	2-Oct-01	Delayed (See #1)

Note #1 Next meeting will be in October.

1.2.5 TRT Electronics

1.2.5.1 ASD/BLR

1.2.5.1.2 Prototype

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
ASDBLR Design Frozen	13-Jul-01	13-Jul-01	13-Aug-01	Delayed (See #1)
Select Final Electronic Design	31-Aug-01	--	31-Aug-01	On Schedule

Note #1 We hope we are on schedule here, the wafer processing problems at TEMIC may cause a delay in getting certifiably good chips from the run submitted in mid January and could cause this date to slip. Nevertheless, the preliminary tests on the "not good" wafers look so good that we are really only looking for statistical verification - otherwise the revised design looks to be in excellent shape and we expect to be able to freeze it.

Richard Van Berg (University Of Pennsylvania)

The first wafers of the DMILL January 15th submission were delivered to us last month, but marked bad by ATMEL since the wafers failed (over large areas) to meet one of the DMILL poly isolation resistances. Nevertheless, given that about half of each wafer seems to have met this spec, we had one wafer diced and 20 copies of the ASDBLR (and 20 copies of the DTMROC) were bonded into ceramic test packages. These first 20 die have now been measured and we now know that:

1) the ASDBLR circuit has no obvious mistakes or errors embedded in it.

2) the matching of thresholds channel to channel on one chip has improved markedly (as the design changes intended).

3) the functional yield is about the same as before (but beware the small statistics and the known bad wafer.

4) the parametric yield is significantly improved, but, again, beware the points noted above.

We have not yet measured the absolute noise figure for this version although stable operation at 2fC implies that the noise is not terrible. We have not yet measured the sturdiness of the "improved" input protection circuitry. Both of these measurements are in progress and results should be available (for these 20 chips) soon.

Reprocessed wafers from TEMIC were delivered to CERN on 2 July and so "claimed good" devices should be available in TQFP packaging in three or four weeks - these devices will allow us to make statistically significant statements on the above measurements.

All in all, a good month.

1.2.5.1.3 Production (Qty = 64,000 + 32,000 Chips)

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
Management Contingency Go-Ahead	2-Jul-01	--	2-Jul-01	On Schedule (See #1)

Note #1 We hope this is on schedule - sort of not entirely under our control though.

Richard Van Berg (University Of Pennsylvania)

Not quite there yet - but progressing in that direction...

1.2.5.2 DTM/ROC

1.2.5.2.1 Design

Richard Van Berg (University Of Pennsylvania)

The DMILL DTMROC design is, we believe, completed. There is, however, an ongoing effort at CERN to translate the design into a deep submicron process (DSM). That effort is proceeding apace and we expect to see the first few sample cells delivered from CERN in the next week or two. We are also working on contributions to the analog cells needed for the DSM version and have completed Ternary Receiver and LVDS driver and receiver circuits and are nearly finished with the testpulse. The goal is to have a full design submitted early in the fourth quarter of calendar 2001.

1.2.5.2.2 Prototype

Richard Van Berg (University Of Pennsylvania)

As noted above, the initial DMILL wafers were out of spec, but we did receive five wafers from the fab gratis and had one wafer sawn up and placed 20 die of each type in ceramic packages. The DTMROCs in the ceramic packages perform as expected (i.e. the pipeline and command decoder lengths have changed by one), about the same 40% of these die were fully working as in the previous fab, but the DAC matching is much better (as hoped but not fully expected since simulations found no particular "smoking gun" (unlike the ASDBLR case where we were reasonably confident that we had improved the circuit. Further measurements of yields and precision timing will need the statistics provided by the TQFP versions from the soon to be delivered backup wafers.

1.2.5.3 PCB - End Cap Richard Van Berg (University Of Pennsylvania)

This is a heading, not an entry, but if there is no text here the system gets upset. So, stay calm.

1.2.5.3.1 Design — Richard Van Berg (University Of Pennsylvania)

All the tests of the most recent design have been very favorable and we believe that this design is nearly "final". If we change to an FPGA package, then there will have to be some pcb revisions, but since the layout would be more open and the package should be lower noise, this should be relatively straightforward and well worth doing.

1.2.5.3.2 Prototype — Richard Van Berg (University Of Pennsylvania)

As noted, the recent tests at CERN have managed to operate the 384 straw sector prototype at below the design threshold (giving us some headroom in either chamber or electronics operating parameters).

1.2.5.5 Beam Test

Milestone	Baseline	Previous	Forecast	Status
End of 01 Test Beam	28-Sep-01	[New]	4-Nov-01	Delayed (See #1)

Note #1 We have been granted additional time up through Nov. 4 01. This is a GOOD thing, so "delay" is too pejorative a term.

Richard Van Berg (University Of Pennsylvania)

The Beam Test for 2001 starts in July and preparations are in place - the DAQ has been tested and, since there have not been any changes since last year, works as expected. Paul Keener is scheduled to be at CERN for the beginning of the test beam period and Kristian Hahn has volunteered to cover the August Sept. segment. We will probably supply a ceramic packaged ASDBLR for use in single channel tests of high rate in the early part of the test beam period - before plastic packaged versions of the ASDBLR00 are available.

1.2.5.6 System Integration & installation

Milestone	Baseline	Previous	Forecast	Status
System Design Certified	1-Oct-01	--	1-Oct-01	On Schedule (See #1)

Note #1 This depends upon getting large enough system tests in place before Oct. and that depends upon getting enough chips from the Jan. submission and that depends upon getting wafers back and there is a glitch there, so hard to be sure that we can make this schedule, but not yet unreasonable - just tight and getting tighter. Also note that this only works for the End Cap, the Barrel milestone must be much later as it depends upon having an actual design in place and we are not there yet for the stamp boards.

Richard Van Berg (University Of Pennsylvania)

The Barrel System Tests at Penn are beginning to bear some fruit. We have now received 10 stamp flex boards from Lund with good wire bonds on the ASDBLRs. We have tested some of these boards and found all channels working (at least until we loved one board too much) and have found a suitable glopping compound to seal and protect the wire bonds. At the moment we are still doing single stamp board tests (using the ROD/TTC readout after the IMS readout has verified basic operation). In the near term, after getting the test beam up and running, we hope to advance to running multiple stamp boards at once off the snake cable to test those interactions.

The stamp boards are fully functional, but the measured noise levels are significantly above those encountered either on the TB3 test board or on the End Cap stack boards. Initial conjecture is centered around the signal routing in the ASD area - in some cases inputs are very close to outputs. In reaction to this observation and the earlier difficulty in getting reliable wire bonds, we have been seriously investigating more advanced packaging options. We now have two vendors willing to provide us with full custom FBGA (Fine pitch Ball Grid Array) packaging suitable for both chips. These packages are only slightly larger than the die themselves, but have board level connections on a reasonably relaxed (0.8mm) pitch - allowing straightforward assembly by a well equipped contract manufacturer. By going to a set of packaged chips it is also possible to find space for full size protection resistors. This combination of advantages plus the topological routing improvements (that might result in lower noise figures) are compelling arguments for pursuing the FBGA option - despite the relatively high NRE charges.

In other studies, we have looked at cross talk on the Duke manufactured module 2.01 and, using a Co^{57} source, are able to measure at a 2% sensitivity level (using both high and low thresholds). At that level there is a very tiny (~0.1% occupancy) hint of some pattern sensitivity. We hope to be able to look at the whole module 2 pattern in this way, but unless some positions are pathological in the extreme, it is likely to be very boring (i.e. good).

1.3 ARGON

Milestones with changed forecast dates:

1.3.2.1.4 Installation

Milestone	Baseline	Previous	Forecast	Status
1st Shipment	23-Apr-01	10-Jul-01	30-Jul-01	Delayed (See #1)

Note #1 First feedthrough shipment will be at the end of July. Cryostat acceptance tests must be completed before start of FT installation.

1.3.2.2.3 Production

Milestone	Baseline	Previous	Forecast	Status
2 Complete HV feedthrough Ports	1-Mar-01	1-Jul-01	25-Jul-01	Delayed (See #1)

Note #1 The delivery of 2 ports will match the cryostat availability at CERN.

1.3.2.2.4 Installation

Milestone	Baseline	Previous	Forecast	Status
Ship End-Cap C to CERN	5-Mar-01	15-Jul-01	25-Jul-01	Delayed (See #1)

Note #1 Delayed due to FT delay. Not on critical path.

1.3.7.1.2 Pre-Proto/Mod 0/Atlas Prototype

Milestone	Baseline	Previous	Forecast	Status
Rad Hard. - All Components	28-Sep-01	28-Sep-01	28-Feb-02	Delayed (See #1)

Note #1 Delayed due to late delivery of rad-tol voltage regulators.

1.3.7.4.2 Prototype/Module 0

Milestone	Baseline	Previous	Forecast	Status
Optical Links ATLAS Prototype	1-Jun-01	1-Jun-01	1-Jun-02	Delayed (See #1)

Note #1 Prototype completed and tested. FEB-end integrated with the layout. ROD-end will depend on the ROD design.

1.3.8.2.1 Design/Electronic Tooling/Comp. Specs

Milestone	Baseline	Previous	Forecast	Status
Circuit Design of ATLAS Receiver Complete	12-Aug-01	12-Aug-01	12-Sep-01	Delayed (See #1)

Note #1 The choice for the variable gain amplifier IC for the receiver is being revisited. We are examining the possibility of using a fast DAC as a variable attenuator as an alternative.

1.3.9.1.1 Design

Milestone	Baseline	Previous	Forecast	Status
Complete Code to form averages of Cal.	18-Jun-01	10-Jul-01	1-Sep-01	Delayed (See #1)

Note #1 Calibration procedure not completely defined

1.3.10.1.3 Production

Milestone	Baseline	Previous	Forecast	Status
FCAL1-C Interconnects Complete	30-Apr-01	30-Jun-01	30-Sep-01	Delayed (See #1)

Note #1 The layout is complete and the printed circuit boards are out to bid. We expect to place the order during the first week of July. This is not on the critical path.

1.3.1 Barrel Cryostat

1.3.1.4 Barrel Cryostat Manufacturing

1.3.1.4.3 Manufacturing Monitor — Jack Sondericker (Brookhaven National Lab.)

By the beginning of June the cryostat location in transport to CERN was close to entering the Suez Canal. On June 16th the ship carrying the cryostat stopped at the port of Southampton, England and then went on to Rotterdam. At Rotterdam the cryostat was loaded onto a barge and started its journey up the Rhine

River June 17th. The barge arrived at Strasbourg on the 25th and offloaded onto an over the road trailer for its trip to CERN. It is expected that the cryostat will arrive at CERN on July 3rd.

1.3.1.5 Assembly & Test in West Hall

Milestone	Baseline	Previous	Forecast	Status
Cryostat Arrives at CERN	15-May-01	--	15-Jul-01	Delayed (See #1)
Final Cryostat Acceptance (KHI-CERN)	31-Aug-01	--	31-Aug-01	On Schedule

Note #1 The arrival date matches the availability of space in Building 180.

1.3.2 Feedthrough

1.3.2.1 FT-Signal

1.3.2.1.1 Design

Milestone	Baseline	Previous	Forecast	Status
I/F Equipment Avail for Final Cryostat Complete	3-Sep-01	--	3-Sep-01	On Schedule

1.3.2.1.3 Production

Milestone	Baseline	Previous	Forecast	Status
20 Ft Complete	31-Dec-00	--	30-Jun-01	Completed
Last Pin Carrier Delivery	1-Mar-01	--	1-Sep-01	Delayed (See #1)
50% of Pin Carriers Delivered	2-Jul-01	--	2-Jul-01	On Schedule
34 FT Complete	15-Oct-01	--	15-Oct-01	On Schedule

Note #1 After initial delay, the production matches the new ATLAS schedule

Bob Hackenburg (Brookhaven National Lab.)

June went reasonably well, with our production up to number 24, and pin carriers remain in a good state with regard to production of satisfactory units; we have no want of pin carriers at the moment, and it looks like that will continue. We are continuing to make plans for the installation. We have had one setback, namely, feedthrough number 22 passed all tests, up to the cold cycle, but then failed the final test just before we were about to crate it up. One signal line briefly developed a high series (in-line) resistance, which then gradually reduced from several Kohm to about 10 Ohm, which is too high to pass. Even if it did pass, the fact that it had a very high resistance for a brief time is reason enough to fail it. We are setting it aside at the moment, while we decide how we can repair it; unfortunately, in its present state, the TDR cannot see the problem, so we don't know where in the feedthrough the difficultly lies (so, we don't know what part to cut open, etc.). When the cold-cycling apparatus is freed up, we may try another cold cycle, in the hope that it will fail worse this time.

At the moment, we have 22 feedthroughs ready to ship, and the first shipment to CERN is imminent.

1.3.2.1.4 Installation

Milestone	Baseline	Previous	Forecast	Status
Installation	17-Jan-01	--	30-Sep-02	Delayed (See #1)
1st Shipment	23-Apr-01	10-Jul-01	30-Jul-01	Delayed (See #2)
Start Installation Procedure	13-Jul-01	--	15-Sep-01	Delayed (See #3)
Last Shipment	31-Oct-01	--	30-Aug-02	Delayed (See #4)

Note #1 The completion date matches new ATLAS schedule.

Note #2 First feedthrough shipment will be at the end of July. Cryostat acceptance tests must be completed before start of FT installation.

Note #3 Installation cannot start before the acceptance tests of the cryostat are complete.

Note #4 The last shipment date matches the new ATLAS schedule. Feedthroughs production will be completed earlier.

1.3.2.2 HV Feedthrough

1.3.2.2.3 Production

Milestone	Baseline	Previous	Forecast	Status
2 Complete HV Feedthrough Ports	1-Mar-01	1-Jul-01	25-Jul-01	Delayed (See #1)
Barrel FTs (Mechanical) Delivered to CERN	1-May-01	--	15-Jul-01	Delayed (See #2)
Barrel FTs (Electrical) delivered to CERN	1-Jun-01	--	15-Jul-01	Delayed (See #3)
Production Complete	14-Sep-01	--	14-Sep-01	Delayed (See #4)

Note #1 The delivery of 2 ports will match the cryostat availability at CERN.

Note #2 The delivery will match the cryostat availability.

Note #3 The delivery will match cryostat availability at CERN.

Note #4 The installation will match cryostat availability.

Michal Rijssenbeek (SUNY Stony Brook)

1.3.2.2.3.1 Warm Connectors

REDEL/LEMO warm HV connectors all in house.

1.3.2.2.3.2 Cold Connectors

Cold connectors all in house.

1.3.2.2.3.3 HV Wire

All wire has been received and used for manufacture of wire feedthroughs.

1.3.2.2.3.6 Sealed Wire FT (WFT)

Douglas Engineering has delivered all 28 WFTs (includes spares).

All WFTs have been tested in water at 5 kV. 2-3 wireloops per WFT found faulty, which is compensated by 2-3 excess loops available in the WFTs. Cleaning of the WFTs was found to be more difficult than anticipated: initially, in excess of ten wipes with ethanol were necessary to fully clean an individual wire! We now pre-clean each WFT in commercial detergent in an ultrasonic bath at ~100 deg F (>2 hrs), followed by soft wire brushing, followed by an ethanol bath (> 2 hrs). The final cleaning step is with alcohol wipes (about 3 wipes per wire now on average). We now do 2-3 WFTs per day and will finish all cleaning by Aug 1. Connector mounting will start thereafter: week of Aug 6.

1.3.2.2.3.4-5 Filter Modules and Filter Crate

All HV parts have been delivered.

1.3.2.2.3.7-9 Vacuum Components for the HV FT

All six HVFTs (flanges, bellows, pipe, ALU/SS transitions) have been received, machined, and have been welded and tested at BNL. We have constructed one shipping crate, which we will use to ship the first mechanical HVFT to CERN in the week of July 23.

1.3.2.2.3.10 Assembly

The first HVFT with four WFTs was tested at 2.5 kV (both polarities were tried) for corona: no corona was observed after 15 minutes (directly after raising the HV, pulses are observed which are due to slow charging up of wire insulation and polarization of the PEEK insulation). The tests lasted overnight and any pulses were recorded automatically.

The feedthrough was tested under pressure, and Helium leak detector tests did not find any leaks.

1.3.2.2.4 Installation

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
Ship End-Cap C to CERN	5-Mar-01	15-Jul-01	25-Jul-01	Delayed (See #1)
Ship Barrel to CERN	1-May-01	--	1-Aug-01	Delayed (See #2)
End-Cap C Install Complete	5-Sep-01	--	25-Nov-01	Delayed (See #3)
Installation HVFT ports on Endcap C	5-Sep-01	--	25-Nov-01	Delayed (See #4)
Barrel Install Complete	1-Nov-01	--	1-Nov-01	On Schedule

Note #1 Delayed due to FT delay. Not on critical path.

Note #2-4 Delay will match the cryostat availability.

Michal Rijssenbeek (SUNY Stony Brook)

Details and order of installation are under discussion with CERN and BNL personnel. Current plans are to install/weld the HVFT before Signal FTs (as in the original plan), but to install the HV cable tree and do the routing afterwards (i.e. with the signal FT cables in place).

1.3.3 LAr Cryogenics

1.3.3.1 LN2 Refrigerator System

1.3.3.1.2 LN2 Ref.System Procurement

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
Proposal Assessment & Contract Start	1-Feb-01	--	10-Jul-01	Delayed (See #1)
LN2 Ref.System Procurement Complete	2-Apr-01	--	15-Jul-01	Delayed (See #2)
Start Production	1-Aug-01	--	1-Aug-01	On Schedule

Note #1-2 Bids are higher than expected. Negotiations continue.

Jack Sondericker (Brookhaven National Lab.)

June LN2 Refrigerator Procurement

Negotiations with both contending companies were carried out to reduce scope of the procurement, where possible, to reduce cost. Near mid June, the proposers were asked to submit a "Best and Final Offer". These BAFOs are returnable on July 3rd. Unfortunately vacations and other conflicts will slow the final review and selection process to where a final decision can only be reached by the end of July, at best.

1.3.3.1.3 LN2 Ref. System Fabrication

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
Ln2 Ref. System Fabrication	1-Jun-01	--	1-Sep-03	Delayed (See #1)
LN2 Ref. System Fabrication Start	1-Jun-01	--	1-Aug-01	Delayed (See #2)

Note #1 The completion date of system installation matches new ATLAS installation schedule.

Note #2 Delay is due to continuing price negotiations. Not on the critical path.

1.3.3.2 LN2 Quality Meter System

1.3.3.2.2 Quality Meter Prototype

Milestone	Baseline	Previous	Forecast	Status
Quality Meter Prototype	1-May-00	--	21-Aug-01	Delayed (See #1)
Final Design Review	1-May-01	--	21-Aug-01	Delayed (See #2)
Specification PRR Review	1-Aug-01	--	1-Aug-01	On Schedule

Note #1 The prototype exists. An improved design with higher reliability is under development.

Note #2 Will match the cryostat installation schedule

Jack Sondericker (Brookhaven National Lab.)

June 2001 Quality Meter Prototype

The electronic design and test of the front end and converter PLC interface boards are complete. Printed circuit layout is underway with board manufacture to follow.

Mechanical pieces of the Quality meter are mostly on hand, only a few parts still on order and expected shortly. Formed stainless steel domed heads for the phase separator were found to be out of tolerance and returned to the manufacturer for replacement. Some minor worry about future progress because of time lost to vacations and summer conferences.

1.3.3.2.3 Quality Meter Production

Milestone	Baseline	Previous	Forecast	Status
Parts and Material Start	29-Aug-01	--	29-Aug-01	On Schedule
Quality Meter Production	1-Oct-01	--	30-Oct-02	Delayed (See #1)

Note #1 Delay matches the new ATLAS schedule

1.3.4 EM Electronics/MB System

1.3.4.2 Motherboard System

1.3.4.2.3 Production

Milestone	Baseline	Previous	Forecast	Status
Delivery of Module 5 boards	1-Jun-01	--	1-Jun-01	Completed
Delivery of Module 6 boards	20-Jun-01	--	20-Jun-01	Completed
Delivery of Module 7 boards	15-Jul-01	--	15-Jul-01	On Schedule

25% MB System Production Complete	6-Aug-01	--	6-Aug-01	On Schedule

1.3.5 Preamp/Calibration

1.3.5.1 Preamps

1.3.5.1.3 Production (QTY=30000)

Milestone	Baseline	Previous	Forecast	Status
Start Preamp Deliveries to FEB	3-Sep-01	--	3-Sep-01	On Schedule

Hong Ma (Brookhaven National Lab.)

IO-826: 1056 received. 1043 passed and ready for shipment. Unchanged from last month.

IO-824: Received 96 from vendor since last report.

Total: 1152 received. 1147 passed and ready for shipment.

IO-823: Received 1344 from vendor since last report.

Total: 4096 received. 960 test in progress. 3103 passed and ready for shipment.

Test Station-I had timing jitter problem. This was traced back to the faulty digital scope input. Currently it is being investigated for noise problem.

Test Station-II is functional and in use.

1.3.5.2 Precision Calor. Calibration

1.3.5.2.3 Production Support to LAPPL/LAL

Milestone	Baseline	Previous	Forecast	Status
Production Readiness Review	1-May-01	--	1-Aug-01	Delayed (See #1)

Note #1 Delay in DMILL chip production

1.3.6 System Integration

1.3.6.1 Pedestal

1.3.6.1.1 Design **Helio Takai (Brookhaven National Lab.)**

Design of barrel pedestal is concluded. Few modifications are being added to the drawings to accommodate the filter box.

1.3.6.1.2 Prototype **Helio Takai (Brookhaven National Lab.)**

We have received the First article pedestal. This unit is for the barrel. The set contains the pedestal, crate, bus bar. We are now installing this crate in the BNL setup for testing. It will be used regularly in the lab for testing of the electronics. The dimensions and the quality of labor are now being evaluated.

1.3.6.1.3 Production **Helio Takai (Brookhaven National Lab.)**

Received first article.

1.3.6.2 Cables/Base Plane

1.3.6.2.1 Design **Helio Takai (Brookhaven National Lab.)**

All of the warm cables have been received. Bid for baseplane was completed and the award went to Tyco electronics.

1.3.6.3 Crate-Mechanical

1.3.6.3.1 Design **Helio Takai (Brookhaven National Lab.)**

See pedestals.

1.3.6.3.2 Prototype **Helio Takai (Brookhaven National Lab.)**

See pedestals.

1.3.6.3.3 Production **Helio Takai (Brookhaven National Lab.)**

First article received.

1.3.6.4.2 Prototype **Helio Takai (Brookhaven National Lab.)**

We have purchased a lot from single diffusion run of power mosfets. These will be used by Modular Devices to produce the first prototypes DC-DC converters.

1.3.6.5 Cooling

1.3.6.5.1 Design **Helio Takai (Brookhaven National Lab.)**

Design of cooling plates is awaiting final figures of power dissipation from the electronics. The technology of roll bond is a good technology to produce them.

1.3.7 Front End Board

1.3.7.1 FEB

1.3.7.1.1 Design **John Parsons (Columbia University)**

Design and layout of the ATLAS FEB has been completed as far as possible until we choose the technology (DSM or DMILL) of the SCA Controller, and until rad-tol voltage regulators are available.

The test jigs for the DSM SCA Controller, Gain Selector and CLKFO chips were completed. The unpackaged die was received at the end of June. After packaging, we will start testing.

We are continuing our investigation of possible backup solutions to the STm voltage regulator development. We have contacted several companies offering rad-tol regulators, and are acquiring samples where possible. These devices, designed for space/military applications, are much more expensive than the STm solution. We are also investigating possible COTs solutions. So far, there is little cause for optimism, and the STm development represents by far the best option, assuming they can solve their technical problems.

1.3.7.1.2 Pre-Proto/Mod 0/Atlas Prototype

Milestone	Baseline	Previous	Forecast	Status
Freeze Component for ATLAS Prototype	1-Mar-01	--	1-Aug-01	Delayed (See #1)
Freeze Connector Location	1-May-01	--	1-Jul-01	Delayed (See #2)
Rad Tol. FEB Design Review	1-May-01	--	3-Sep-01	Delayed (See #3)
1st Delivery of Layer Sum Boards	2-Jul-01	--	2-Jul-01	On Schedule
Feb - ATLAS Layout Complete	21-Aug-01	--	21-Aug-01	On Schedule
Critical Design Review	3-Sep-01	--	3-Sep-01	On Schedule
Start Assembly	11-Sep-01	--	11-Sep-01	On Schedule
Rad Hard. - All Components	28-Sep-01	28-Sep-01	28-Feb-02	Delayed (See #4)

Note #1 Delayed due to requirement for additional radiation testing of COTs.

Note #2 Delayed due to delay in finalizing TTC connector.

Note #3-4 Delayed due to late delivery of rad-tol voltage regulators.

1.3.7.1.5 Radiation Testing **John Parsons (Columbia University)**

Further analysis of the SEU test results for the DMILL COnfiguration COntroller and Gain Selector show implied error rates in ATLAS which are negligible.

We have booked the weekend of July 28/29 at the Harvard cyclotron for the irradiation of the new DSM chips, and also of voltage regulators being examined in the search for a backup solution to the STm development.

1.3.7.2 SCA

1.3.7.2.1 Design **John Parsons (Columbia University)**

Testing of the engineering run SCA chips is being done by our Orsay/Saclay colleagues. The PRR is expected to take place in October.

1.3.7.4 Optical Links

1.3.7.4.1 Design — John Parsons (Columbia University)

Proton irradiation tests of the GLink show an SEU rate much lower than that extracted from the earlier neutron tests. The reasons for the discrepancy are not yet understood. However, the higher numbers from the neutron tests are still acceptable for operation in ATLAS.

1.3.7.4.2 Prototype/Module 0

Milestone	Baseline	Previous	Forecast	Status
ATLAS Prototype	1-Jun-01	--	1-Jun-01	Completed
Optical Links ATLAS Prototype	1-Jun-01	1-Jun-01	1-Jun-02	Delayed (See #1)

Note #1 Prototype completed and tested. FEB-end integrated with the layout. ROD-end will depend on the ROD design.

1.3.8 Trigger Summation

1.3.8.1 Layer Sums

1.3.8.1.3 Production (Qty = 3,441 Boards)

Milestone	Baseline	Previous	Forecast	Status
Last Delivery of Layer Sum Bds	1-Jul-01	--	1-Jul-01	On Schedule (See #1)
Start Deliveries to FEB (ORSAY/Nevis)	2-Jul-01	--	1-Jan-02	Delayed (See #2)

Note #1 The last delivery of the LSBs was made in June.

Note #2 Delivery will be started to Nevis or Orsay only when requested.

Bill Cleland (University Of Pittsburgh)

In June, the final shipment of LSBs was sent to us by the assembler. We have now completed burn-in and testing on about 25% of the boards. A problem with the S1x16 high gain board has been found. If the input is for some reason disconnected (due to a broken pin or trace on the FEB) the output rides to +5 V, which will saturate the trigger sum. This problem can be solved by adding a resistor to ground at the input, and a pad for such a resistor exists on the board. Adding the resistor will cause a small gain shift, which can be corrected by replacing another resistor. Thus the fix will require the removal on one resistor and the addition of two resistors on each of 16 channels on the board. This work is needed on 200 boards, for which the time estimate is about 10 days. It will be done in September.

1.3.8.2 Interface to Level 1

1.3.8.2.1 Design/Electronic Tooling/Comp. Specs

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
Circuit Design of ATLAS receiver Complete	12-Aug-01	12-Aug-01	12-Sep-01	Delayed (See #1)
Final Design Complete	4-Oct-01	--	4-Oct-01	On Schedule

Note #1 The choice for the variable gain amplifier IC for the receiver is being revisited. We are examining the possibility of using a fast DAC as a variable attenuator as an alternative.

Bill Cleland (University Of Pittsburgh)

Prototype boards for testing the various parts of the receiver system have been received, and assembly has been completed. These boards will permit evaluation of the scheme to transfer monitoring signals on the backplane and the multiplexing of these signals to the monitoring outputs. The variable gain circuit is being studied in an attempt to improve the contribution to the noise made the receiver circuit, for which this IC is the dominant source.

1.3.9 ROD System

1.3.9.1 ROD Board

1.3.9.1.1 Design

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
Reconstruct E, T, and chi square for TB data	12-Feb-01	--	1-Jul-01	Delayed (See #1)
Complete Code to form averages of Cal.	18-Jun-01	10-Jul-01	1-Sep-01	Delayed (See #2)
Complete Code to get OFC from CAL. Data	4-Sep-01	--	4-Sep-01	On Schedule (See #3)

Note #1 Done, not completely reviewed.

Note #2-3 Calibration procedure not completely defined.

Rod Engelmann (SUNY Stony Brook)

Rod Engelmann (SUNY Stony Brook)

In June the following work was done:

BNL/Stony Brook - ROD demo tests: The DAQ-1 data acquisition software had the trigger control implemented. Work with the calibration board continued and work with a trigger analyzer board was begun comparing the analog signal with the digitizations.

Nevis Lab: A software data compression algorithm was implemented on the 62X and software changes for the new 6203 PU hardware were made.

SMU: Code development for averaging calibration data in the TI C62 DSP continued. SMU has a full version of the TI Code Composer software and work on rebuilding the 6202 code at SMU and running it at BNL was begun.

1.3.10 Forward Calorimeter

1.3.10.1 FCAL1 Module

1.3.10.1.3 Production

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
FCAL1-C Interconnects Complete	30-Apr-01	30-Jun-01	30-Sep-01	Delayed (See #1)
FCAL1-C Matrix on Carrier	23-Jul-01	--	15-Jun-01	Completed (See #2)
FCAL1-C Tube Swaging Complete	1-Oct-01	--	31-Aug-01	On Schedule (See #3)

Note #1 The layout is complete and the printed circuit boards are out to bid. We expect to place the order during the first week of July. This is not on the critical path.

Note #2 Completed on Tuesday 12 July.

Note #3 I've aggressively moved up the forecast date to our present best estimate.

John Rutherfoord (University Of Arizona)

FCal1 Module

On Tuesday June 12th the last matrix plate for FCal1C was stacked. At that moment we achieved the milestone "Matrix on Carrier". The last plate had an approximately 2 mm gap at the inner bore between it and the rest of the matrix when the outer periphery was flush. We interpreted this to mean that the last plate was "dished" a bit. To fix it we inserted washers at the tie rods around the outer periphery to produce a gap between the last matrix plate and the rest of the plates and then put a clamp through the inner bore and tightened it so as to draw the inner bore flush. This dished the last matrix plate just beyond its elastic limit in the opposite direction. After removing the washers the last plate was flush at the inner bore when flush at the outer periphery. In other words, the matrix is now complete and put together as planned. The stack up depth of the module is within specs at all points we can measure.

It was discovered that the two missing ground pin holes on each end plate (which we drilled by hand) were missing from the CNC list. The shop has fixed the list so this problem should not be repeated on the A end. (In any event it is a trivial problem.)

All of the copper electrode tubes were prepared some time ago and are stored in plastic tubs with dry nitrogen flowing through. When the matrix was completed we started inserting these tubes into the matrix. We decided to introduce a rigorous inspection of each tube as we inserted it. This has slowed down the insertion step dramatically. At first we were able to insert about 120 tubes a day. With two people in the clean room making a mini-production line we were able to increase the rate above 200 per day. Our goal is 300 per day so we can complete this phase in 40 days (2 months). So far no tube has failed to slide into place in the matrix.

With the new LArG schedule we foresee a shift in the FCal construction schedule. Formerly we planned to complete the modules for the C end and then perform the final assembly of the C end at CERN. Then we would return to Arizona to complete the A modules and move to CERN again for the final assembly of the A end. But now we must overlap operations so that we are completing the assembly of the A modules at Arizona while another team is doing the final assembly of the C end at CERN. As soon as the final assembly of the C end is completed, the final assembly of the A end starts. This means there is one long period at CERN for the final assembly team rather than two shorter terms. We saw the possibility of this shift in sequence last year and have been planning the details as it became more apparent it would happen.

We are slowed a bit because of the loss of our Engineering Aide, Ted Moreno, to the lure of a much bigger salary and a permanent position in industry. We are interviewing candidates to replace him. We anticipate we won't completely finish the A module before the away team moves to CERN so we need a competent aide to supervise it to completion.

Leif Shaver was visiting SIMIC in Italy the last week of June. SIMIC is the company producing the endcap calorimeters and, of particular interest to us, the aluminum support tube into which our FCal modules will be inserted during the final assembly phase. Leif took with him some precision measuring tools and one of our PVC models of a matrix plate. He is determining whether the inner bore of this support tube was machined well enough to fit our modules as planned.

About 49% (12,054) of the copper electrode rods have been drilled for the signal pins. The drilling is going along rapidly and should be completed in a few weeks. R&D on cleaning these copper rods has started in earnest. So far it appears this will be difficult because of the machining compounds which are hardened onto the rods.

We have assembled the arguments for changing the FCalA modules from identical to the C end to mirror images of the C end. And we have discussed this change within the FCal community, with Bill Cleland, and with the machine shop producing the FCal1A plates. The FCal community strongly supports this change. We propose no change in the cabling or the electronics. We are prepared to make the case at the July LArG Week. This change is simple and invisible outside the FCal community. It does not impact the schedule and it makes the somewhat awkward readout tiles more symmetrical at the analysis stage. The machine shop has estimated the penalty in cost and schedule and neither is a concern. We anticipate no problems in getting approval from the LArG. But we have yet to negotiate with US ATLAS.

The interconnect printed circuit boards, which hold the sockets which attach to the signal and ground pins on the module, are out to bid. Bids are due next week and an order should be placed before mid-July.

1.3.10.2 FCAL Electronics

1.3.10.2.3 Production

Milestone	Baseline	Previous	Forecast	Status
PCBs received at AZ	21-Nov-00	--	15-Dec-01	Delayed (See #1)

A Cables Delivery from Axon	2-Jul-01	--	2-Jul-01	On Schedule (See #2)

Note #1 Layout of printed circuit boards is complete and will go out for bids in the first week of July.

Note #2 No new news on this. We expect delivery sometime in July. This milestone is FAR from the critical path.

John Rutherfoord (University Of Arizona)

Cold Electronics:

The relay boards for switching between cables of ten cable harnesses in the cold during our production characterization are due back from the stuffing house in the first week of July. We have yet again changed the controller chip on the board in the warm which manages these relay boards. This requires more (but minor) re-programming.

We expect to go out for quotes on the summing boards during the first week of July. The quote on the manufacture of the transmission line transformers looks good but we still don't know delivery. We are trying to get that information. We decided to place the planned 100 test production order and expect to follow that up with an order for the complement of 4000 required.

1.4 TILE

Milestones with changed forecast dates:

1.4.2.1.3 Production

Milestone	Baseline	Previous	Forecast	Status
100% Tile Deliveries from Russia Compl	2-Jul-01	2-Jul-01	2-Sep-01	Delay (See #1)

Note #1 Tile production is nearly completed in Russia. The sorting of tiles at CERN into lots for the 4 instrumentation sites has added a delay into the expected delivery schedule. This will not affect the module instrumentation schedule.

1.4.4.1.3 Production

Milestone	Baseline	Previous	Forecast	Status
Scintillator procurement	1-Oct-00	1-Aug-01	1-Oct-01	Delayed (See #1)
Start Scintillator Assembly	1-Dec-00	1-Sep-01	1-Nov-01	Delayed (See #2)

Note #1 Prototypes of the ITC extension scintillators were tested at the CERN test beam last summer. Based on the test beam experience, we have made final modifications to the scintillator design. Procurement will follow as soon as final drawings are approved, and funding to buy extension scintillators are available at MSU.

Note #2 Prototypes of the ITC extension scintillators were tested at the CERN test beam last summer. Based on the test beam experience, we have made final modifications to the scintillator design. Assembly will follow as soon as funding to buy extension scintillators are available at MSU.

1.4.1 Extended Barrel Mechanics **James Proudfoot (Argonne National Lab.)**

Work is proceeding well and (essentially) on schedule in all areas.

49 special submodules and 114 standard submodules have been constructed at Argonne for a total of 163. Submodule construction activities at the University of Chicago have been completed with a total of 194 constructed (albeit with caveats concerning 19 of these as described in earlier reports). All remaining inventory from Chicago has been shipped to Argonne. In addition, one of the rejected UC submodules has been repaired at Argonne. This repair demonstrated that we have a cost-effective way to recover at least 11 of the out of specification submodules. The fabrication plan for the construction of the special cut submodules has been worked through and is ready to implement once the production drawings are signed off and funds are available. Submodule construction at the University of Illinois continues at a slightly higher than the originally planned rate & is recovering some early schedule slippage.

Module construction is also proceeding. A total of 36 modules have been constructed. 31 modules have been fully instrumented and tested, with 26 of these no shipped to CERN. Modules continue to meet specification in all areas. Two module shipments to CERN are planned for July which will put us back on the canonical shipping schedule. No problems have been encountered with any of the shipping activities and we have in fact been able to accommodate a request by the Michigan State group to provide modules at a slightly higher rate through the summer months.

Progress continues on the engineering design and analysis in connection with final assembly. A comprehensive summary paper has been written and will be reviewed and discussed by the Tilecal engineering group in September (the report is accessible on the web at the address given below).

1.4.1.1 Submodules

1.4.1.1.3 Production **Steven Errede (University Illinois-Urbana-Champaign)**

In June 2001, we made 10 ATLAS Tilecal submodules. We have now made a total of 153 submodules. Because a significant portion of the floor of our high-bay lab area here at UI is currently being replaced (wood to concrete), we shipped 8 fully completed submodules to Argonne in mid-June. A total of 144 submodules have now been shipped to Argonne from UIUC.

Victor Guarino (Argonne National Lab.)

During the month of June eight submodules were constructed. No problems were encountered during the construction of these submodules and the regular maintenance was performed on the production equipment.

During June the remainder of the materials from UC to construct submodules was shipped to ANL. This consisted of approximately 90 master plates, 3 sets of spacers, 16 sets of epoxy and a few hundred spring pins and spacer #13's.

James Pilcher (University Of Chicago)

Submodule production at Chicago was completely shut down by the end of May and only small cleanup tasks were done in June. We will try to keep the equipment in place until all US sites have completed submodule production but do not plan any further reports unless conditions change.

1.4.1.2 Extended Barrel Module

1.4.1.2.3 Production **Victor Guarino (Argonne National Lab.)**

During the month of June modules #ANL36 and #ANL37 were constructed. No problems were encountered during the construction of these modules.

Extensive work also continued on the design and structural analysis of the support structure for the extended barrel and the EB cryostat supports. The basic design for the support saddles has been completed and detailed drawings have been fabricated. A detailed analysis has been carried out which examined the loads from the EB onto the support saddles, the stresses in the saddles, and its deflections. In addition, the support structure which will support the back cryostat feet has been redesigned and analyzed in order to simplify the design and reduce its cost. Additional work needs to be completed to examine the affect of the earthquake loading on the saddles and the cryostat supports. This should be completed in July.

A detailed report of this analysis can be found at the following web site: http://gate.hep.anl.gov/vjg/

1.4.1.4 Testing

Milestone	Baseline	Previous	Forecast	Status
Beam test Series A	2-Oct-01	--	2-Oct-01	On Schedule

1.4.2 Extended Barrel Optics

1.4.2.1 Extended Barrel Scintillator

1.4.2.1.1 Design **Robert Miller (Michigan State University)**

Optical Instrumentation Summary

Instrumentation of the US Tilecal extended barrel modules reached 50% completion in June. One module was completed at MSU and one at ANL. A total of 31 modules have been instrumented and tested, with 4 additional modules in various stages of production.

1.4.2.1.3 Production

Milestone	Baseline	Previous	Forecast	Status
100% Tile Deliveries from Russia Compl	2-Jul-01	2-Jul-01	2-Sep-01	Delayed (See #1)

Note #1 Tile production is nearly completed in Russia. The sorting of tiles at CERN into lots for the 4 instrumentation sites has added a delay into the expected delivery schedule. This will not affect the module instrumentation schedule.

Robert Miller (Michigan State University)

At MSU, module ANL-29 was completed in June. Modules 28 and 29 were scanned with the LED source and shipped back to ANL. Module ANL-34 and 35 were shipped to MSU. Tiles and fibers were installed in modules ANL-31 and 34. Module 35 was prepared for instrumentation. Starting with module 34, the new batch of tiles is being used for the B and D cells. Special masking is no longer needed to compensate for different light yield in different layers.

1.4.2.2 Extended Barrel Fibers

1.4.2.2.3 Production

Milestone	Baseline	Previous	Forecast	Status
65% Fibers in Profiles from Lisbon to ANL & MSU	2-Jan-01	--	1-Jul-01	Delayed (See #1)
50% Module Instrum Complete	29-Jun-01	--	29-Jun-01	Completed

Note #1 Initial delivery of WLS fibers and profiles was delayed by about 6 months due to start up problems with the robot facility in Lisbon. Production and delivery of these components is now proceeding at a rate that matches the module instrumentation rate, but is expected to continue on a just-in-time schedule.

Robert Miller (Michigan State University)

The last few modules have required more than the usual number of fiber repairs and replacements during instrumentation QC checks and after the initial certification scan with the LED. Many of these problems have been due to fibers that have come detached from the profiles and are not completely covering the tile. We find that the technique of inserting a spare WLS fiber into each cell has paid off in simplifying the repair procedure.

1.4.3 Readout

1.4.3.1 PMT Block

1.4.3.1.3 Production

Steven Errede (University Illinois-Urbana-Champaign)

We continued STEP1 testing of Batch 5 PMTs during June 2001. By the end of the month, we had completed testing of ~ 200 out of 250 PMTs in this batch. We anticipate that we will complete testing of this batch in early July.

1.4.3.2 Front-end 3-in-1 Card

1.4.3.2.3 Production

Milestone	Baseline	Previous	Forecast	Status
3-In-1 Card Test 50% Complete	1-Jun-01	--	15-Jun-01	Completed

3-In-1 Card Test 100% Complete	30-Nov-01	--	30-Nov-01	On Schedule

James Pilcher (University Of Chicago)

As reported in May, production of 3-in-1 cards by the vendor is complete and all cards have been received at Chicago for burn-in and testing.

In June 568 3-in-1 cards passed burn-in and testing and were shipped to CERN. This brings the number shipped to 51% of the total. The monthly average over the 8-month period since burn-in and testing began is now up at 681 cards per month and our most recent 3-month running average is 955 per month. Our original estimates were for 867 per month. Thus our current throughput is above the expected rate and the long-term average should continue to climb slowly.

A database giving the test results according to serial number is available on the web.

1.4.3.3 Front-end Motherboards

1.4.3.3.3 Production

Milestone	Baseline	Previous	Forecast	Status
MB Card Fab 10% Complete	29-Jan-01	--	30-Jun-01	Completed
MB Card Fab 25% Complete	12-Feb-01	--	31-Jul-01	Delayed (See #1)
MB Card Fab 50% Complete	28-Feb-01	--	31-Jul-01	Delayed (See #2)
MB Card Test 10% Complete	1-Mar-01	--	31-Jul-01	Delayed (See #3)
MB Card Fab 100% Complete	6-Apr-01	--	31-Aug-01	Delayed (See #4)
MB Card Test 25% Complete	1-May-01	--	1-Oct-01	Delayed (See #5)
MB Card Test 50% Complete	1-Aug-01	--	30-Nov-01	Delayed (See #6)

Note #1-6 On track for current forecast and not on critical path.

James Pilcher (University Of Chicago)

In June we saw regular delivery of Mother Boards according to the schedule agreed to with the vendor. By the end of June we had received 35, 77, 24, 24, 16 of MB1, MB2, MB3, MB4, and the Mezzanine card. This represents 13%, 28%, 9%, 9%, and 6% of the total order or an overall average of 13% of the total boards of all kinds in the order.

Burn-in and testing got underway and 6 compete sets had been shipped to CERN by the end of June. This is enough to fully equip the electronics drawers needed for module calibration in the test beam in July.

1.4.3.6 Read System Management

Milestone	Baseline	Previous	Forecast	Status
Test BM Calib of 4 Prod. Modls.	1-Oct-01	--	1-Oct-01	On Schedule

James Pilcher (University Of Chicago)

Tilecal is on schedule to do test beam calibration of 2 production barrel modules and 4 production extended barrel modules this summer. Materials for the electronics drawers have been provided to Clermont Ferrand for their integration work.

1.4.4 Intermediate Tile Calorimeter

1.4.4.1 Gap Submodules

1.4.4.1.3 Production

Milestone	Baseline	Previous	Forecast	Status
Scintillator procurement	1-Oct-00	1-Aug-01	1-Oct-01	Delayed (See #1)
Start Scintillator Assembly	1-Dec-00	1-Sep-01	1-Nov-01	Delayed (See #2)
Ship submodules 37-40 to ANL	11-Jun-01	--	11-Aug-01	Delayed (See #3)
Ship submodules 37-40 to BCN	18-Jun-01	--	18-Jun-01	Completed
Ship submodules 41-44 to ANL	27-Aug-01	--	27-Aug-01	On Schedule
Ship submodules 41-44 to BCN	3-Sep-01	--	3-Sep-01	On Schedule
Ship submodules 45-48 to ANL	26-Nov-01	--	26-Nov-01	On Schedule

Note #1 Prototypes of the ITC extension scintillators were tested at the CERN test beam last summer. Based on the test beam experience, we have made final modifications to the scintillator design. Procurement will follow as soon as final drawings are approved, and funding to buy extension scintillators is available at MSU.

Note #2 Prototypes of the ITC extension scintillators were tested at the CERN test beam last summer. Based on the test beam experience, we have made final modifications to the scintillator design. Assembly will follow as soon as funding to buy extension scintillators are available at MSU.

Note #3 Due to delayed startup of production in 1999, we are 2 months behind original schedule. There is no impact on module production.

Kaushik De (University Of Texas At Arlington)

Two ITCs were shipped to Argonne and two more to Barcelona in June, as scheduled. We have finalized the production and delivery schedules in consultation with the two sites for the rest of the year. We don't anticipate any more technical difficulties and expect production to continue smoothly.

In June, we finished production of the special ITC0004 types for Barcelona. These submodules are missing the section made with short plates. We are now setting up for production of the first special ITC0002, which will be shipped to Barcelona in July. These submodules have no middle section, though the stack height remains the same as standard ITC submodules. We have made all the tools and modified parts for these special ITCs.

We are having a lot of success in recovering the bad laser cut plates. Thousands of these were rejected during quality control. We are remachining them using a precision CNC machine in our physics department shop. We are currently recovering as many as 75% of these previously rejected plates.

We finished testing the first batch of PMTs sent to UTA. Only one PMT out of 250 were rejected. All test data from Step 1 have been sent to CERN. We are waiting for the second batch in July. We are also waiting to receive the final parts for Step 2 testing.

1.4.4.2 Cryostat Scintillators

1.4.4.2.3 Production

Milestone	Baseline	Previous	Forecast	Status
Scintillator procurement	1-Dec-00	--	1-Dec-01	Delayed (See #1)
Start Scintillator Assembly	7-Sep-01	--	7-Sep-01	On Schedule
Management Contingency Go-Ahead	1-Oct-01	--	1-Oct-01	On Schedule

Note #1 Scintillator purchase and production of the ITC crack scintillators is delayed pending the decision to authorize this part of the project that was included in the management contingency fund. That decision is scheduled for 1 Oct. 01. Funding for the mechanical components was approved in Feb. 01, and those components will be purchase in FY 01.

Robert Miller (Michigan State University)

Production and repairs of the ITC fiber assemblies was paused during June while attention was given to module instrumentation. This will not affect the final production schedule.

1.5 MUON

Milestones with changed forecast dates:

1.5.7.2.2 Gas System

Milestone	Baseline	Previous	Forecast	Status
Finish Gas System Design	7-Jun-01	7-Jun-01	15-Aug-01	Delayed (See #1)

Note #1 Design efforts now focus on design of the gas system for the special chambers with cutouts. Design of EIL2/3/special gas bar is in process.

1.5.7.3.3 Series Production Precision Tooling

Milestone	Baseline	Previous	Forecast	Status
Finish Series Production Tooling	1-Feb-01	15-Jun-01	15-Jan-02	Delay (See #1)

Note #1 All the Series 2 production tooling for the three U.S. MDT sites is now complete. However, parts for the special chamber tooling (Series 3 @ Seattle is the first case) are delayed because the details of the special chamber design are not yet complete. Several specifications have to be finalized - such as the location of the alignment line cutouts - before the production tooling for all the U.S. MDT chambers can be finished.

1.5.12.1.1 Alignment Bars

Milestone	Baseline	Previous	Forecast	Status
Alignment Bar Design Complete	30-Mar-01	30-Jun-01	30-Mar-02	Delayed (See #1)

Note #1 Design for H8 is complete and there is no work on this item at this time. This design will be reviewed following analysis of H8 results. (By then we hope TC will stop moving the wheels around.) Final design will take place at that time.

1.5.12.1.5 DAQ

Milestone	Baseline	Previous	Forecast	Status
Complete design of H8 alignment DAQ hardware.	1-Apr-01	30-Jun-01	1-Aug-01	Delayed (See #1)
DAQ Design Complete	28-Sep-01	28-Sep-01	30-Mar-02	Delayed (See #2)

Note #1 All basic designs are completed but detailing of some components is continuing.
Note #2 The H8 version basic design is complete. This design will be reevaluated following analysis of H8 data and, if needed, will be revised at that time.

1.5.12.2.3 H8 DATCHA

Milestone	Baseline	Previous	Forecast	Status
H8 Operational	24-Nov-00	30-Jul-01	1-Sep-01	Delayed (See #1)

Note #1 The assembly of support structures and frames at CERN has been slower than expected. This is now completed but the area will be unavailable for mounting devices for much of July because the beam will be on. Most components are expected to arrive in August.

1.5.12.3 Global System Production

Milestone	Baseline	Previous	Forecast	Status
Critical System Design Review	3-Jan-01	31-Aug-01	31-Mar-02	Delayed (See #1)
Align Bar/Prox Monitors PRR	3-Jan-01	31-Oct-01	31-Mar-02	Delayed (See #2)

Note #1-2 Not yet scheduled but will follow analysis of H8 results.

1.5.12.3.1 Alignment Bars

Milestone	Baseline	Previous	Forecast	Status
Bar Production 10% Complete	1-Oct-01	1-Oct-01	1-Jun-02	Delayed (See #1)

Note #1 This is no longer a US responsibility and will be done at Freiburg. Bar production will not begin until after analysis of H8 results.

1.5.12.4.5 EIS1 (Boston)

Milestone	Baseline	Previous	Forecast	Status
Ship to Site	16-Feb-01	15-Jun-01	1-Aug-01	Delayed (See #1)

Note #1 The latest MDT production schedule has shifted the delivery date of the inplane system to Jun 1, 2001. The first kit has been shipped. Complete shipments awaiting feedback from production site and availability of V2 header cards.

1.5.12.4.6 EIS2 (Boston)

Milestone	Baseline	Previous	Forecast	Status
Ship to Site	23-Oct-01	23-Oct-01	1-Feb-02	Delayed (See #1)

Note #1 Changes in MDT production schedule has moved this chamber to the third round of production. Since this is a special chamber, confirmation of the inplane design will await completion of the design of the chamber.

1.5.12.4.17 EMS2 (Seattle)

Milestone	Baseline	Previous	Forecast	Status
Ship to Site	23-Jan-01	15-Jun-01	1-Aug-01	Delayed (See #1)

Note #1 The latest MDT production schedule has shifted the delivery date of the inplane system to Jun 1, 2001. The first kit has been shipped. Complete shipments awaiting feedback from production site and availability of V2 header cards.

1.5.4 CSC Chambers

1.5.4.4 CSC Construction

Milestone	Baseline	Previous	Forecast	Status
Start CSC Chamber Production	1-Mar-01	--	1-Sep-01	Delayed (See #1)

Note #1 Start of production will likely slip further pending completion of the work on documentation, procurement specification, and other open issues identified during the November 27 PRR.

1.5.4.4.1 CSC1

Milestone	Baseline	Previous	Forecast	Status
4 Chambers Complete	1-May-01	--	1-Dec-01	Delayed (See #1)
16 Chambers Complete	2-Oct-01	--	30-Apr-02	Delayed (See #2)

Note #1-2 This milestone follows the delay in start of construction, now scheduled for September 1.

1.5.4.5 CSC Support Structure

Milestone	Baseline	Previous	Forecast	Status
Start Support Structures Construction	3-Jan-01	--	3-Dec-01	Delayed (See #1)

Note #1 The small wheel fabrication is expected to be launched by the end of the year. The contract and follow-up will be CERN responsibility.

1.5.7 MDT Chamber Production

1.5.7.1 Engineering Management

1.5.7.1.1 Chamber Integration Drawings

Milestone	Baseline	Previous	Forecast	Status
Complete Chamber Integration Drawings	1-Jul-01	--	1-Oct-01	Delayed (See #1)
Chamber Integration Drawings	28-Sep-01	--	28-Sep-01	On Schedule
Chamber Integration Drawings	28-Sep-01	--	28-Sep-01	On Schedule

Note #1 The complete chamber assembly drawings for the EIS1, EMS4 and EMS2 were delayed until the FC for these chambers was finalized. This occurred during this reporting period and completion of these drawings can continue. Information of T-sensor lacations and B-Sensor lacations remains unavailable. The drawings will be updated with this info as it is released.

Richard Coco (MIT)

Chamber Integration drawings for the multi-layer assembly for next Series of MDT chambers to be assembled were completed and released to the three production sites. These drawings are for are chambers - EIS1 (BMC); EMS4 (UM) and EMS2 (UW).

Integration Drawings for the next Series of chambers will be started during the next reporting period.

1.5.7.1.2 Engineering Documentation **Richard Coco (MIT)**

Engineering documentation released include the Faraday Cage Assembly document written by D. Marzocchi, Chamber integration drawings for EIS1, EMS4, EMS2, and gas manifold machining drawings.

1.5.7.1.4 QA/QC Engineering Support **Richard Coco (MIT)**

Engineering support to QA/QC activities is provided as required or requested.

1.5.7.1.5 Project Engineering **Richard Coco (MIT)**

Project engineering activities include supervision of the design, procurement and engineering documentation activities at the BMC engineering office as well as monitoring schedules.

1.5.7.2 Design of Chambers and Tooling

1.5.7.2.1 Faraday Cages

Milestone	Baseline	Previous	Forecast	Status
Finished Faraday Cage Designs	21-Dec-00	--	22-Aug-01	Delayed (See #1)

Note #1 FC for EIL1 is complete and parts have been made. Designs of FC for 3x8x8.5, 3x8x14 and 4x6x 8.5 deg have been completed and released for pre-production run. These will be evaluated for fit on production chambers, the design tweaked if necessary and released for production.

Richard Coco (MIT)

The design of the faraday cage (FC) for the 4x6x8.5 Deg chambers was completed during this reporting period and the drawings released for quote and procurement of an initial pre-production set of parts. This 4x6x8.5 Deg FC parts checked for form and fit by installation on the first EIS1 chamber assembled at BMC. The design will be updated as required to correct any production errors or design interferences found and at that point released for final production.

At this point all FC designs for the four different type chambers to be assembled have been completed. The remaining major FC task is to complete the design of the mezzanine card enclosure box.

Pre-production parts for both the 3x8x8.5 Deg and 3x8x14 Deg chambers were procured and drop shipped to UM and UW for test installation on chambers. The FC designer (D. Marzocchi) plans to visit UW and if required UM to assist in installing the pre-production parts and checking out form and fit.

1.5.7.2.2 Gas System

Milestone	Baseline	Previous	Forecast	Status
Finish Gas System Design	7-Jun-01	7-Jun-01	15-Aug-01	Delayed (See #1)

Note #1 Design efforts now focus on design of the gas system for the special chambers with cutouts. Design of EIL2/3/special gas bar is in process.

Richard Coco (MIT)

Machining drawings for all gas manifold bars except for the special design required for the EIL2-3 chamber have been released.

Noryl Gas block machining in process at Tufts was complete during this reporting period.

Lengths of the brass gas tube extension for connecting the gas feed to the gas manifold bar were defined for the 4x6x14 Deg, 3x8x14 Deg and 3x8x8.5 Deg chambers. Length is dictated by Faraday Cage heights. Length of the final brass tube for the 4x6x8.5 Deg chambers will be defined with the completion of the faraday cage design for these chambers.

1.5.7.2.4 Chamber Analysis

Milestone	Baseline	Previous	Forecast	Status
Finish FEA Modeling	30-Aug-01	--	30-Aug-01	On Schedule

Henry Lubatti (University of Washington)

Josh Wang created a model of an EIL2-3 chamber in Ansys for load deflection analysis.

1.5.7.2.5 design of Special Chamber Tooling

Milestone	Baseline	Previous	Forecast	Status
Finish all Special Chamber Tooling	27-Sep-01	--	27-Sep-01	On Schedule

Richard Coco (MIT)

Preliminary deign concepts for the special chambers with cutouts are in process.

1.5.7.3 Tooling

1.5.7.3.1 Module 0-Precision Tooling

1.5.7.3.3 Series Production Precision Tooling

Milestone	Baseline	Previous	Forecast	Status
Finish Series Production Tooling	1-Feb-01	15-Jun-01	15-Jan-02	Delayed (See #1)

Note #1 All the Series 2 production tooling for the three U.S. MDT sites is now complete. However, parts for the special chamber tooling (Series 3 @ Seattle is the first case) are delayed because the details of the special chamber design are not yet complete. Several specifications have to be finalized - such as the location of the alignment line cutouts - before the production tooling for all the U.S. MDT chambers can be finished.

1.5.7.3.5 BMC Tube Assembly Station — Frank Taylor (MIT)

The BMC tube assembly station continues to operate. The tube crew (Toohey, Govoni, deSantis, French) is now working on module 5 of EIS1. The effort is enhanced by the addition of Jennifer French (UW physics student) for the summer. She has been concentrating on the assembly of endplugs.

1.5.7.3.8 BMC Tube Test Station — Frank Taylor (MIT)

Tube testing continues at the BMC. The failure rate for EIS1 tubes has been typical of the EIL1 rate. So low wire tensions have been observed - one to the point of rejection - are and being investigated. The low tensions have been observed in short tubes which are quite sensitive to small movements of the wire crimp point. A check of wire tensions was made of tubes more than 2 months old. No evidence of any long-term relaxation was observed.

1.5.7.3.11 BMC Chamber Assembly Station

Milestone	Baseline	Previous	Forecast	Status
EIS1 Drawings available	15-Apr-01	--	1-Jun-01	Completed
EIS1 tooling drawings delivered to BMC	15-Apr-01	--	1-Jun-01	Completed
EIS1 tooling parts delivered to BMC assembly group	15-May-01	--	10-Jun-01	Completed
Start Retooling for EIS1	14-Jun-01	--	14-Jun-01	Completed
Start EIS1 Production	10-Jul-01	--	10-Jul-01	On Schedule

Krzysztof Sliwa (Tufts University)

Tufts completed machining of 483 gas blocks by third week of the month which consumed the available Noryll stock. Approximately 20 more gas blocks are needed to complete production of these units; additional Noryll stock has been ordered by Tom Fries at Harvard.

Fabrication of parts for the chamber alignment system was carried out by the Tufts shop using drawings prepared by the Brandeis group. Manufacture of proximity sensors distance-setting parts was completed during the second week of the month, and the PMO spacers were fabricated shortly thereafter. Preparations for fabrication of spacer frame setting brackets were underway in the Tufts shop at the end of the month.

Optimal utilization of the Tufts shop for the summer was brought up for discussion by Tony Mann at the BMC meeting of 6/26. It was proposed and agreed that Tufts would scope out the costs and machining time requirements for fabrication of the sphere blocks jigging required for completion of chamber building. Items required include six of level-four pieces, six of 304 mm "trophy" pieces and six of 307 mm "trophy" pieces. At the end of the month, the aluminum stock required for this build was ordered by Harvard. Review of drawings in consultation with Hermann Welenstein is underway. Tufts will carry out all machining required during the next four to six months.

Alex Marin (Boston University)

See milestones. As of June 26, the retooling for EIS1 chamber status is (Ahlen, Haggerty, Hennessy, Hurst, Gorskov, Marin):

1. All PMO and OPS EIL1 calibrations done

2. Stiffback assembled

3. Combs installed

4. Vaccuum system done

5. Preliminary alignment/BCAL done

6. Jigging and production of spacer frames started (three done at this time).

1.5.7.6 Common Procurement

1.5.7.6.1 Procurement of Tubes — Tom Fries (Harvard University)

Batch #79(EML3) was delivered to UM, Batch #84(EMS3) was delivered to UW, and Batch #73(EIS2) was delivered to BMC. These are 3rd serie s of tubes.

1.5.7.6.2 Procurement of Wire — Tom Fries (Harvard University)

No additional wire was received in June. However, there is enough wire on hand for many months' production.

1.5.7.6.3 Procurement of Endplugs — Tom Fries (Harvard University)

4,395 CERN Endplugs were received and distributed among the 3 US sites.

Additionally, between 10k and 11k of MPI-style Endplugs are being prepared for delivery in July. This quantity will provide a 6 week buffer inventory.

1.5.7.6.4 Procurement of Faraday Cage — Tom Fries (Harvard University)

With EMS & EML FC drawings released for production, delivery of prototype FC parts to UM & UW occurred the last week of June.

Meanwhile back at BMC, the EIL-1 first-piece FC pieces were successfully attached to a chamber for evaluation.

1.5.7.6.5 Procurement of Gas Supply System — Tom Fries (Harvard University)

Tubeletts:

The domestic supplier (ATB) has delivered about 95% of an order for 20 chamber's worth of brass tubeletts. Once the tooling is adjusted, they will complete the order. Enough tubeletts to complete 8 chambers was sent to UM for assembly (UW preferred to wait for Heim tubes).

The European supplier (Heim) received our tooling approval the first week of June. They are expected to deliver production quantities next month.

Retainers, Tubelette:

The supplier (Walter Hugin) received our tooling approval the last week of June. Now a production order will be issued that ought to result in product within a month.

Gas Bars:

11 Type-II Gas Bars (requiring Al sleeves and hold-down bars) fabricated at the UW machine shop were delivered to UM.

Gas Blocks:

Noryl material was drop-shipped to the Tufts U machine shop for fabrication of 500 Gas Blocks. Delivery is expected in July.

1.5.7.6.6 Procurement of Spacer Frame + Attachment Henry Lubatti (University of Washington)

Josh Wang continued to work on drawings of various spacer frame parts for the third series of US endcap chambers.

Josh Wang worked with the Seattle machining shop to get machining started on the series 3 cross plates.

1.5.7.7 BMC Chamber Construction 104

1.5.7.7.1 EIL 1 Series (WBS 1.5.7.7.1)

Milestone	**Baseline**	**Previous**	**Forecast**	**Status**
End of EIL1 series production	14-Jun-01	--	14-Jun-01	Completed (See #1)

Note #1 Mod 16 completed on June 8

Alex Marin (Boston University)

EIL1 base chambers series completed on June 8 (Ahlen, Haggerty, Hennessy, Hurst, Marin, Gorskov). He retooling started n June 11.

1.5.7.7.2 EIS1 series (WBS 1.5.7.7.2) **Frank Taylor (MIT)**

Roughly 1300 tubes have been made for EIS1 chambers - about 8 weeks ahead of chamber production need. Storage of finished tubes has become a problem.

1.5.7.8 WBS 1.5.7.8 Michigan Chamber Construction 104

1.5.7.8.1 EMS5 Series (WBS 1.5.7.8.1) Ed Diehl (University of Michigan)

The EMS5 series of chambers was finished on June 4, 2001. The comb alignment was re-surveyed with the BCAL and compared with previous measurements made over the past 13 months. The absolute comb positions (height & lateral position) were found to have remained constant over this period with an RMS of 8.7 microns.

We also compiled OPS and stiffback RASNIK results for the EMS5 series. We found that the stiffback RASNIK (6 lines) height and lateral positions had a repeatability of 5-7 microns. The OPS height measurements RMS 7.4 microns while the lateral position RMS was 18 microns. The OPS lateral position measurements are known to have suffered from errors due to loose OPS bases which we hope to correct in the EMS4 series. Due to the instability of the OPS lateral position measurements we also measured lateral position with a micrometer whose measurements had an RMS of 12 microns. Due to the redundancy in measurements from the stiffback RASNIK, OPS, and micrometer measurements we are confidant that the EMS5 series was built within ATLAS tolerances. These results were confirmed by x-ray tomographs done at CERN on 2 chambers which that wire positions we place with an RMS < 20 microns.

We discovered that the 8.5-degree angle combs had developed a 30-micron bow (ends sagging). This bow was not seen in an initial survey at the beginning of EMS5 production and is presumable due to metal fatigue in the angle combs (which are cast aluminum). The straight combs (which are extruded) do not show this bowing.

The last shipment of 5 EMS5 chambers was shipped to CERN on June 26. One EMS5 chamber was retained in order to set up and cosmic ray test.

1.5.7.8.2 EMS4 Series (WBS 1.5.7.8.2) Ed Diehl (University of Michigan)

After finishing EMS5 production the rest of June was used to retool for EMS4 production.

Tube room retooling was fairly minor and accomplished by mid-June. Tube production re-commenced mid-June and we had 2 chambers of tube finished by month's end.

We removed all jigging from the granite and cleaned off any glue from the surface (with razor blades and alcohol). The granite was re-surveyed with tiltmeter and BCAL and found to have remained fairly stable. There was some evidence increase of bowing along the length of the table from 20 to 30 microns.

The stiffback was re-made and changed from 5 panels to 3 panels permitted by the smaller size of the EMS4 chamber. This change cause several simplifications: reducing the number of sphere block towers from 10 to 6; and reducing the number of stiffback RASNIK lines from 6 to 2. We planned to reflatten the stiffback vacuum chucks if needed (by sucking them down on the granite and retightening the panels), but this was found to be unnecessary. We took several steps to increase the rigidity of the stiffback. We added a single diagonal strip between the 3 panels to reduce displacements between the 3 panels. We also mounted the u-channels stiffening the plate connecting the 3 vacuum panels on the outside of the plate, so that the u-channels (2 per side) could run the entire length of the stiffback panel unbroken. Previously, these u-channels were on the inside of the stiffback, and so could not run continuously along the entire length.

We added white diffuser glass to the OPS masks to improve OPS image quality. The OPS masks were shimmed to make them parallel to the granite surface. We also discovered that we had not matched OPS bases and towers on the previous setup (we had not realized they were made in match sets) which have corrected. We also improved the hold-downs for the OPS bases by using a central hold-down through the hole in the base (as before), plus a holddown on one corner (new). Previously, we had found the OPS bases were not held completely rigid, leading to errors. However, simply clamping harder on the center holddown is not ideal as it distorts the shape of the base.

We discovered, as mentioned above, that the 8.5-degree angle combs have a 30-micron bow. We were able to remove this bow by adding supports at the ends of the comb where the sagging occurred. After this fix the combs were flat to an RMS of 4 microns, same as the straight combs.

The EMS4 setup uses 7 combs: 2 angle, 5 straight. The 5 straight combs were aligned to a wire viewed through a microscope. The preliminary alignment uses a normal microscope with a reticle accurate to 4 microns. A more precise alignment is then done using a microscope with CCD readout and computer analysis to determine wire position to 2 microns. The combs are held at one end with the h-blocks and lightly clamped at the Bessel points.

Once the straight combs were aligned the angle combs were aligned to them to set the tube pitch. A quick way to do this was to use the BCAL to fit a line to the straight combs and then to use the BCAL to measure the deviation of the angle comb to this line and to adjust accordingly. This measurement can be done on the fly, greatly reducing the time required for alignment.

We made several upgrades to the glue machine. We raised the height of the gantry so it passes over the OPS towers, obviating the need to move the OPS towers. We also added stiffening rods to the glue nozzles which had become dented with use. The nozzles were initially made of brass which is easily dented. The nozzles are far more durable with the addition of stiffening rods.

We also have en-devoured to improve our glue-mixing stand. For EMS5 we premixed glue using pneumatic glue guns and epoxy syringes. We pre-filled syringes from a bucket which was tedious and messy. We're now trying to mix glue by directly pumping from a bucket, avoiding the syringes, and reducing cleanup. The system uses manual pumps connected to 5 gallon buckets fed to a mixing tube. The system basically works, but must be improved with experience. In particular, it is a bit difficult to force the glue through the mixing tube with the manual pump. We are also concerned that the glue-mixing ratio is maintained.

Retooling has been taking somewhat longer than planned. We now expect to start EMS4 production by mid-July.

In the gas manifold world we forge ahead pre-making gas manifolds on our gas manifold assembly stand. We discovered some problems with the very small o-rings used in tubelets in the gas manifold. We find that a large fraction of these o-rings (10%-30%) have problems either with flashing, dirt, or distorted shapes. Seattle, who supplied these o-rings, has been informed and, we trust, is seeking a solution. Meanwhile we are hand screening these o-rings with a low-powered microscope.

We have pre-assembled and tested 16 gas manifolds (4 chambers) with stainless steel tubelets. Unfortunately, these tubelets suffer variations in diameter resulting in non-uniform flow rates. We will hold off using these, until a given a go-ahead by the proper authorities. We are also trying to make gas manifolds with the brass tubelets from Advanced Tubes (US supplier). Unfortunately, we have found several problems with these tubelets. The tubelets are extremely dirty and require ultra-sonic cleaning with Oakite (phosphoric acid), followed by water and alcohol rinses. Tubelet assembly is also problematic because these tubelets are made of soft brass which is easily bent.

1.5.7.9 WBS 1.5.7.9 Seattle Chamber Construction 96

1.5.7.9.2 EES2 series* (WBS 1.5.7.9.2) Henry Lubatti (University of Washington)

We made some revisions to the tube assembly line for EMS2 drift tube production and redid the alignment. We upgraded our software and made some revisions of the control software. We completed 384 drift tubes for EMS.2A02 and 200 drift tubes for EMS.2A04. We assembled 1500 end plugs.

1.5.7.9.3 EMS2 Series (WBS 1.5.7.9.3) Paul Mockett (University of Washington)

EMS2 Production Chamber Construction

1.5.7.9.3

A substantial fraction of June was used to define and understand the bowing observed in the 14-degree combs. A bow in the comb does not produce a degradation of the track measurement since angles in the multilayers are preserved. But the observed bowing was a surprise. It seems that most of the bow was due to an instability in the MIC6 alloy used in the comb bases. Additional bow seems to have been induced by the H block clamping at the fixed end. The total run out when clamped was about 40 microns and unclamped about 20 microns. The total run out on the unclamped 8.5-degree combs was 28 microns for the West comb and 16 microns for the East comb.

Also the two 14 degree combs and the middle straight comb were found to be out of line by almost 100 microns with respect to the other four combs. Why or how this quantized discrepancy occurred has not been determined. However we decided to clamp very hard at the long end bessel point rather than use the H block. The H blocks will only be used to fix the lateral positions of the combs.

Continued the change-over to new configuration for the construction of EMS2 modules. This included:

Setup of fixturing and construction of three EMS2 spacer frames. Change-over of two rotator frames from 14 to 8.5 deg and size chambers.

Modification of stiffback spreader frame (changing hole patterns) for new size stiffback. Modification of stiffback - installation of internal Rasniks for 85 deg. chambers, new end bars, side panels and optics. Repositioned sphere blocks and aligned to combs.

Measurement of 14 deg. combs for bowing and removed from granite table. Measurement of 8.5 deg. combs and straight combs for alignment. Found that combs were misaligned with each other and no bowing in straight combs. Decided not to use h-blocks for clamping since they contributed to bowing. We now use only the Bessel pts. for hold-down.

Repositioned 8.5 deg. combs using microscope/ccd camera and wire. Repositioned OPS bases and aligned with combs and stiffback. We now have good images that analyze. Reconfigured tube ht. measuring shelves and measuring tools. Begin relocation and alignment of Peemo bases and camera. Nearly completed tooling for peemo cameras and Rasniks which mount on each chamber - 75% complete.

1) Memory upgrades arrived for EPC-1316's and were installed. All systems seem to work fine. I have given Joe a 64Meg module to take to CERN to upgrade the EPC-1316 there.

2) Received the Lattice Download cables. Downloaded the cable software from Lattice. Updated the board from Original programs to Version 1 using new Files from Kevan H.

3) Thoroughly tested the new VME CCD readout board from Kevan. We now use the internal timer for the new hardware. This seems to work fine. Haven't had any problems yet.

4) Wrote a new dll to work with new VME hardware in a "native" mode. It uses the same parameters as the original, but uses the new internal timer, and new register names.

5) Have started to completely rewrite the image capture software for chamber construction. This rewrite will allow the values to be saved directly to the database, as well as to text files. This system will also integrate the old and new hardware, since both are required. Ari and Denise will work on modifying the current version of the database entry program, so that is now will work with the image capture system. Matt Stockbridge and Dan Allred are creating new tube position and tube height software as well.

6) Supervised Denise Dennis in the assembly of a spare motor controller board. Also she completed one temperature readout board and is working on 2 more.

7) Resurrected the wire location camera and software for Chamber Comb alignment. A soon as the computer is upgraded in that room, the hardware will become obsolete since the software will only work with very early versions of the Windows operating systems (Win95/98). Most likely, using a Rasnik Camera will be a good alternative.

DCS status report for June 2001 WBS 1.5.9.5

Wrote VMESCAN.EXE. This is a small dos program that will scan both 24 - and 32 - bit address space and display the address of all boards found. By default, the program will also display the first 25 registers of the VME card. Switches allow for the register output to be suppressed, and for a small help file to be displayed.

TEMP Sensor status report WBS 1.5.7.6.8

Final design for temperature interface boards has been made, and sent into Advanced Circuits. They will be ready mid-July. I am also now finding a vendor for large quantities of TMP37 sensors.

1.5.8 MDT Supports

1.5.8.1 Mechanical Design

1.5.8.1.1 Kinematic Mounts — Colin Daly (University of Washington)

Design work is complete.

1.5.8.1.2 Chamber Mount Struts **Colin Daly (University of Washington)**

The design of the MDT mount struts cannot be finalized until the final layout of the chamber support structures is completed at CERN. This includes the Small Wheel, Big Wheel and the structures on the BT that support the EIL4 chambers. The basic design of the struts is complete. It is the end of the strut that attaches to the support structures that cannot be done at this time. Note that this end actually is actually attached to the chamber position adjusting device which sits between the end of the strut and the support structure. This device is a CERN responsibility.

1.5.8.1.3 Integ with Support Structure

Milestone	Baseline	Previous	Forecast	Status
(SM Wheel) CERN Design/FEA Complete	15-Jul-00	--	1-Dec-01	Delayed (See #1)
(Big Wheel) CERN Design/FEA Complete	1-Feb-01	--	15-Dec-01	Delayed (See #2)
50% Complete	1-Aug-01	--	1-Aug-01	Delayed (See #3)

Note #1 A large fraction of this work has been completed, but as we depend on CERN for the detailed small wheel design from CERN and others for alignment bar and plumbing information we have a delay. Some small progress was made in May. We forecast that this will not be completed until December 1, 2001.

Note #2 Because we depend on CERN for the detailed big wheel design and others for alignment bar and plumbing information we have a delay. We forecast that this will not be completed until March 15,2002. The May design report on the Big Wheel showed much progress but the final drawings and bid specs will not likely be available until Dec, 15, 2001. It is expected that there will be further design and installation changes during the bid process.

Note #3 This milestone is delayed for the reasons given in notes 2 and 3.

Colin Daly (University of Washington)

The Small Wheel integration effort continues. CERN is doing a significant redesign to remove some interference between the structure and the alignment system. Work also continues on interfacing the mount struts to the Small Wheel.

1.5.8.2 Production

1.5.8.2.1 Kinematic Mount Production **Colin Daly (University of Washington)**

Production of Kinematic mount parts continues to be on schedule. All parts for the Series I and II chambers have been completed.

1.5.8.2.2 Chamber Mount Struts **Colin Daly (University of Washington)**

No production possible until design is complete.

1.5.9 MDT Electronics

1.5.9.1 Mezzanine Card

1.5.9.1.1 MDT-ASD

Milestone	Baseline	Previous	Forecast	Status
ASD PRR	19-Oct-01	--	19-Oct-01	On Schedule

George Brandenburg (Harvard University)

The second and hopefully final octal ASD prototype, ASD01a, has just been received and testing is underway. The first prototype, ASD00a, was successfully tested earlier this year and resulted in a few improvements being made in ASD01a.

1.5.9.1.2 Mezz PCB

Milestone	Baseline	Previous	Forecast	Status
Mezz PCB Certified	16-Nov-01	--	16-Nov-01	On Schedule

George Brandenburg (Harvard University)

The remainder of the 10K Test Mezz Lite boards (225 3x8 and 75 4x6) have been received and are being tested. So far the failure rate is only a few percent and these have been easily repaired. They will be shipped to the collaboration in August.

The first prototype octal Mezz (Stout) 410 which uses ASD00a and AMT-1 has been received. However, rather than concentrating on testing this board we are immediately proceeding with the second prototype 411 which uses ASD01a and AMT-2. This will eliminate the need for a Complex Programmable Logic Device (CPLD) to process the ASD threshold init string, as this function will be performed by AMT-2.

1.5.9.2 Hedgehog Cards

1.5.9.2.1 Signal Hedgehog 3X8

Milestone	Baseline	Previous	Forecast	Status
Hedgehog PCB Certified	30-Aug-00	--	1-Aug-01	Delayed (See #1)
Hedgehog Production Complete	28-Feb-01	--	31-Dec-02	Delayed (See #2)

Note #1 Delayed to consider design changes: shortening, coating change. Also the HV capacitor vendor selected is unacceptable to CERN; we must evaluate other vendors and choose a replacement.

Note #2 Production will most likely now take place at CERN starting in the last quarter of 2001. The first production quantities should be available at the end of 2001. Production will continue during 2002 in parallel with chamber building.

George Brandenburg (Harvard University)

The remainder of the 10K test 3x8 signal hedgehogs have been received and are being tested.

Both the production signal and high voltage hedgehog designs have been finalized and final prototypes are being checked this summer. Production should be underway this fall.

1.5.9.3 Patch Panels

1.5.9.3.1 Signal Patch Panel — George Brandenburg (Harvard University)

The remaining 10K test Mezz-CSM adapter boxes are being assembled and will be ready for shipment in late August.

We have received samples of the shielded ribbon cable for the production Mezz-CSM cables and will be testing prototype cable assemblies this summer.

1.5.9.4 Chamber Service Module

Milestone	Baseline	Previous	Forecast	Status
CSM-1 Prototype	1-Sep-00	--	1-Jun-02	Delayed (See #1)

Note #1 The scope of the CSM-1 has recently changes to a simpler, more robust design. As a result the completion date of the first prototype has moved to spring 02. Work on the design for this more ambitious design is progressing.

1.5.9.5 Detector Control System — Paul Mockett (University of Washington)

MT wrote VMESCAN.EXE. This is a small dos program that will scan both 24 - and 32 - bit address space and display the address of all boards found. By default, the program will also display the first 25 registers of the VME card. Switches allow for the register output to be suppressed, and for a small help file to be displayed. JR traveled to CERN to attend alignment meeting and work on H8 during the summer.

1.5.11 CSC Electronics

1.5.11.1 ASM1 Boards

1.5.11.1.1 Design

Milestone	Baseline	Previous	Forecast	Status
Preamp/Shaper Final Design Review	2-Oct-01	--	1-Dec-	Delayed (See #1)

			01	
System Critical Design Review	2-Oct-01	--	1-Dec-01	Delayed (See #2)

Note #1 Delayed to allow us to verify design modifications to preamp/shaper for yield enhancement, reduced crosstalk, and improved overload recovery.

Note #2 Delayed to allow us to verify design modifications to preamp/shaper for yield enhancement, reduced crosstalk, and improved overload recovery.

Paul O'Connor (BNL)

Preamp/shaper was redesigned for lower input impedance, crosstalk. Chip layout was completed at the end of July, first fabrication run after complete layout verification, probably July - August MOSIS run. No warnings from MOSIS about discontinuing process; we have until at least July 2002 to submit production order. ASMI board flex connecter in fabrication in BNL PCB shop.

1.5.11.2 ASM II Board

1.5.11.2.1 ASM II Board design — Paul O'Connor (BNL)

ASM 2b design in progress throughout June. Will be ready to go to layout in mid-August. New MUX chip has been identified, preliminary specifications compiled. We will prototype the logic in an ALTERA MAX FPGA and are laying out a HP 0.5-micron chip with same functionality and pinout. Optical link will be tested in duplex mode using ASM II a.

1.5.11.4 Sparsifiers

1.5.11.4.2 Sparsifier Prototype

Milestone	Baseline	Previous	Forecast	Status
Sparsifier 1st Proto in Hand	1-Aug-01	--	15-Jul-01	On Schedule (See #1)

Note #1 Generic processing unit prototype complete and tested. Motherboard in layout.

1.5.11.5 ROD's

1.5.11.5.1 ROD design — David Stoker (University of California Irvine)

During June, work continued on the layout of the ROD motherboard. Parts for the prototype ROD were ordered. Coding of the SPU (Sparsifier Processing Unit) C and assembly code continued. We also began C coding of the Clock Generation drivers, which run in the ROD's HPU (Host Processing Unit). Prototype code for neutron rejection by the ROD's RPU (Rejection Processing Unit) was completed and benchmarked.

1.5.11.5.2 ROD Prototype

Milestone	Baseline	Previous	Forecast	Status
RODs 1st Proto in Hand	2-Apr-01	--	15-Jul-01	Delayed (See #1)

Note #1 Generic processing unit prototype complete and tested. Motherboard in layout.

1.5.11.7 Software

1.5.11.7.1 Software design

Milestone	Baseline	Previous	Forecast	Status
S/W Conceptual Design Review	2-May-01	--	15-Jul-01	Delayed (See #1)

Note #1 Development of code external to ROD and documentation not ready for review.

1.5.12 Global Alignment System — Jim Bensinger (Brandeis University)

The principal activity this month have been working on H8 and dealing with the recent discovery that the two thirds of the alignment stay clear lines were blocked by the barrel toroid and some of those same lines were blocked by the feet. In meetings with various designers most problems were resolved.

For H8, the stands for EO, EM, and EI were installed. EO and EM were surveyed. EI has yet to be installed in the proper place. Work began preparing the phantom chambers for installation.

We made the first shipment of inplane systems and proximity mounts for the second round of production. These devices used the new long wire alignment DAQ (V2). V2 drivers were also shipped.

1.5.12.1 Global Design

1.5.12.1.1 Alignment Bars

Milestone	Baseline	Previous	Forecast	Status
Alignment Bar Design Complete	30-Mar-01	30-Jun-01	30-Mar-02	Delayed (See #1)

Note #1 Design for H8 is complete and there is no work on this item at this time. This design will be reviewed following analysis of H8 results. (By then we hope TC will stop moving the wheels around.) Final design will take place at that time.

Jim Bensinger (Brandeis University)

The internal sensors for the 2.6 m bars for H8 were sent to CERN to be installed. We continue detailing the bar mounts for H8. This month the proximity mask mounts were submitted to the shop. Arrangements were made to produce the polar/radial mounts at Freiburg. The detailing of these mounts is still pending.

1.5.12.1.2 Proximity Monitors

Milestone	Baseline	Previous	Forecast	Status
Proximity Monitor Design Complete	29-Sep-00	--	7-Aug-01	Delayed (See #1)

Note #1 Delays in H8 and new information from simulation have pushed this item back.

Jim Bensinger (Brandeis University)

A prototype header board for the proximity monitor camera was produced. It worked and the H8 version is planned for next month.

1.5.12.1.3 Multi-Point System (BCAM) **Jim Bensinger (Brandeis University)**

The prototype of the H8 BCAM met or exceeded all operational parameters. The H8 version was sent to an outside shop to produce 100 units.

1.5.12.1.4 System Design **Jim Bensinger (Brandeis University)**

While attending the Muon Week meeting in Gaeta, we were informed (surprised) by TC that 16 of the 24 polar alignment stay clears were blocked by the barrel toroid and in some cases also by the feet of the rail system.

The mid-eta lines were blocked by the toroid voussoirs and the low eta lines were blocked by the struts. On a subsequent trip to CERN, in a meeting with the Saclay engineers about the interference problems, voussoir problems were resolved quickly. The problems with the struts had potential resolutions but final agreement is pending confirmation by FEA calculations.

Four stay clears go by the feet in sectors 12 and 14. These were discussed with the CERN design team. One has no interference. One interference was resolved with no problem. On line will require some redesign of the end foot and require muon group approval. One line (mid-eta in sector 14) can probably not be recovered. Simulation shows that loss of this line will result in a factor of two worse resolution in the local neighborhood of that line only. We will attempt a work around but the fall back position will be to live without that one line.

1.5.12.1.5 DAQ

Milestone	Baseline	Previous	Forecast	Status
Complete design of H8 alignment DAQ hardware.	1-Apr-01	30-Jun-01	1-Aug-01	Delayed (See #1)
DAQ Design Complete	28-Sep-01	28-Sep-01	30-Mar-02	Delayed (See #2)

Note #1 All basic designs are completed but detailing of some components is continuing.

Note #2 The H8 version basic design is complete. This design will be reevaluated following analysis of H8 data and, if needed, will be revised at that time.

Jim Bensinger (Brandeis University)

Work continues on the Long Wire DAQ system. Version 2.2 of the driver board was submitted for prototyping and the design for V2.3 is being developed. We worked on the design of the BCAM header and built a thermistor header. Inplane headers and mask LED boards are produced.

Versions of this system have been distributed to each of the US MDT production sites and CERN. They will be used for testing inplane systems during production and at H8.

Documentation was written and posted on the web for the LW-DAQ, LW-Driver, the inplane headers, and the TC255P manual.

1.5.12.2 Operational Test Stands

1.5.12.2.3 H8 DATCHA

Milestone	Baseline	Previous	Forecast	Status
H8 Operational	24-Nov-00	30-Jul-01	1-Sep-01	Delayed (See #1)

Note #1 The assembly of support structures and frames at CERN has been slower than expected. This is now completed but the area will be unavailable for mounting devices for much of July because the beam will be on. Most components are expected to arrive in August.

Jim Bensinger (Brandeis University)

Meaningful progress was made in the setup of H8. The EM frame was raised and surveyed, the frames for the EO layer were mounted on the tripods, the EI frame was modified for the changes in layout due to changes in the layout of the EI chambers (MDT and CSC) and the alignment lines. The frame was then moved to the H8 area. All of the frames are now in approximately the correct position. (The EI frame has to be surveyed and aligned with the other two.)

Work began on retrofitting the phantom chambers with proximity mounts for cameras and masks. Plans for cable trays and cabling the system were made. The CMM in Freiburg is being recalibrated in preparation for measuring the alignment bars. The Version 2 of the Long Wire DAQ system (a driver and some header cards) were delivered to CERN.

1.5.12.3 Global System Production

Milestone	Baseline	Previous	Forecast	Status
Align Bar/Prox Monitors PRR	3-Jan-01	31-Oct-01	31-Mar-02	Delayed (See #1)
Critical System Design Review	3-Jan-01	31-Aug-01	31-Mar-02	Delayed (See #2)

Note #1-2 Not yet scheduled but will follow analysis of H8 results.

Jim Bensinger (Brandeis University)

The part of system production that has begun is that relating to the production of MDT chambers, the inplane system and the camera mounts and mask mounts for the proximity monitors that go on the chambers.

1.5.12.3.1 Alinment Bars

Milestone	Baseline	Previous	Forecast	Status
Bar Production 10% Complete	1-Oct-01	1-Oct-01	1-Jun-02	Delayed (See #1)

Note #1 This is no longer a US responsibility and will be done at Freiburg. Bar production will not begin until after analysis of H8 results.

1.5.12.3.2 Proximity Monitors — Jim Bensinger (Brandeis University)

We have begun delivering the mask and camera mounts for the second round of production to the US production sites.

1.5.12.4 MDT Inplane Monitors

1.5.12.4.1 Common Items — Jim Bensinger (Brandeis University)

Almost all of the common parts for the approved MDT chamber production now exists at Brandeis or on produced chambers.

1.5.12.4.5 EIS1 (Boston)

Milestone	Baseline	Previous	Forecast	Status
Ship to Site	16-Feb-01	15-Jun-01	1-Aug-01	Delayed (See #1)

Note #1 The latest MDT production schedule has shifted the delivery date of the inplane system to Jun 1, 2001. The first kit has been shipped. Complete shipments awaiting feedback from production site and availability of V2 header cards.

Jim Bensinger (Brandeis University)

One kit has been delivered to Harvard along with drivers for the V2 LW-DAQ system. Further deliveries will await feedback from the production team.

1.5.12.4.6 EIS2 (Boston)

Milestone	Baseline	Previous	Forecast	Status
Ship to Site	23-Oct-01	23-Oct-01	1-Feb-02	Delayed (See #1)

Note #1 Changes in MDT production schedule has moved this chamber to the third round of production. Since this is a special chamber, confirmation of the inplane design will await completion of the design of the chamber.

1.5.12.4.17 EMS2 (Seattle)

Milestone	Baseline	Previous	Forecast	Status
Ship to Site	23-Jan-01	15-Jun-01	1-Aug-01	Delayed (See #1)

Note #1 The latest MDT production schedule has shifted the delivery date of the inplane system to Jun 1, 2001. The first kit has been shipped. Complete shipments awaiting feedback from production site and availability of V2 header cards.

Jim Bensinger (Brandeis University)

One kit has been delivered to Seattle along with drivers for the V2 LW-DAQ system. Further deliveries will await feedback from the production team.

1.5.12.4.18 EMS3 (Seattle)

Milestone	Baseline	Previous	Forecast	Status
Ship to Site	7-Sep-01	--	1-Apr-02	Delayed (See #1)

Note #1 This chamber is not scheduled to be built until the third round of MDT production.

1.5.12.4.19 EMS4 (Michigan) Jim Bensinger (Brandeis University)

One kit has been delivered to Michigan along with drivers for the V2 LW-DAQ system. Further deliveries will await feedback from the production team.

1.6 TRIGGER

Milestone	Baseline	Previous	Forecast	Status
LVL2 Trigger Prototype Complete	30-Sep-01	--	30-Sep-01	On Schedule

1.6.1 LVL2 SRB

1.6.1.1 SRB Design

1.6.1.1.3 SRB design M&S Robert Blair (Argonne National Lab.)

The TTC receiver PMC cards are being refabricated. They will be hand carried to CERN next month for use in the testbeam and phase 2a program. Design for the new RoI Builder is beginning and a draft of the RoI Builder users requirement document has been circulated in preparation for the July preliminary design review. The draft was put together by Jim Schlereth and Michael Levine.

1.6.1.2 SRB Protos

1.6.1.2.4 SRB Prototype Travel

Milestone	Baseline	Previous	Forecast	Status
Calo for Integ Study Compl	30-Sep-01	--	30-Sep-01	On Schedule
Prototype SRB Assy Compl	30-Sep-01	--	30-Sep-01	On Schedule

1.6.2 LVL2 Calorimeter Trg

1.6.2.1 Calo Design

1.6.2.1.1 Calo Design EDIA — Robert Blair (Argonne National Lab.)

John Dawson has been discussing design of a Gigabit Ethernet ROD with David Frances of CERN. This might be a drop in replacement for the current Odin G-link based driver. Discussions with a number of parties needs to proceed to make certain that the timing of this sort of work is reasonable. It is clear that a Gigabit Ethernet replacement simplifies the readout system, in the sense that it may use only commodity off the shelf hardware, but it may serve to delay final front-end design. This needs to be reviewed by a broader community, probably the DIG should take this up since it involves more than just the trigger and DAQ groups. In the meantime John has started to look at the technical issues in terms of ROD design.

1.6.2.2 Calo Protos

Milestone	Baseline	Previous	Forecast	Status
Prototype Calo PDR	31-Mar-01	--	31-Jul-01	Delayed (See #1)
Prototype Calo Assy Compl	30-Sep-01	--	30-Sep-01	On Schedule

Note #1 This PDR as several others has been delayed to conform to the initial review of the Phase 2a prototype. This aligns it with the Atlas wide milestones presented to the LHCC in March.

1.6.3 LVL2 SCT Trg

1.6.3.1 SCT Design

1.6.3.1.1 SCT Design EDIA — Andrew Lankford (University Of Calif. At Irvine)

Study of alternative implementations of the ROD/ROB interface continued in June. The conceptual design developed in May of ROBin's that can be mounted on RODs and become the basis of a network-based Readout Subsystem (ROS) was refined to incorporate a newer DSP chip and output on Gigabit Ethernet instead of Fast Ethernet. A rough cost estimate was also developed. This approach seems very simple and flexible. It also looks less costly than some bus-based implementations. Nevertheless, system issues of a network-based ROS need more study.

Discussions continued with the LArg ROD architecture task force on the subject of possible Readout Link implementations and of the interface between the ROD subsystem and the Readout Subsystem. The LArg group has decided to design their ROD with a transition card that will implement the interface to the Readout Link. This design will allow implementation of either fiber or copper Readout Links or ROBin's with ethernet output. We also began investigations of locating RODs and ROS's in close proximity to each other in order to allow copper Readout Links, which would be somewhat less costly than fiber. Existing plans call for locating all RODs below ground in USA15 and all ROS's on the surface.

1.6.3.1.4 SCT Design Travel

Milestone	Baseline	Previous	Forecast	Status
SCT for Integ Study Compl	30-Sep-01	--	30-Sep-01	On Schedule

1.6.3.2 SCT Protos

Milestone	Baseline	Previous	Forecast	Status
Prototype SCT PDR	31-Mar-01	--	31-Jul-01	Delayed (See #1)
Prototype SCT Assy Compl	30-Sep-01	--	30-Sep-01	On Schedule

Note #1 This PDR as several others has been delayed to conform to the initial review of the Phase 2a prototype. This aligns it with the ATLAS-wide milestones presented to the LHCC in March.

1.6.4 Architecture & LVL2 Global Trigger

1.6.4.1 Arch. Design

Milestone	Baseline	Previous	Forecast	Status
Prototype Project PDR	31-Mar-01	--	31-Jul-01	Delayed (See #1)

Note #1 This PDR as several others has been delayed to conform to the initial review of the Phase 2a prototype. This aligns it with the ATLAS-wide milestones presented to the LHCC in March.

1.6.4.1.1 Arch. Design EDIA — Andrew Lankford (University Of Calif. At Irvine)

Work continued with TDAQ system leaders on project planning for the development and prototyping period preceding the HLT/DAQ/DCS TDR. Preliminary work breakdown structures and schedules were developed for the Online Software and Physics and Event Selection Architecture systems, and a high-level WBS was developed for the Detector Control System. Considerable effort was invested in preparing a status report for the TDAQ Project for the LHCC Comprehensive Review of ATLAS, which will take place during the first week of July.

Haimo G. Zobernig (University Of Wisconsin)

After finishing up the Performance Measurements on the Reference Software, which were reported in early June at the RT2001 Conference in Valencia, Spain, the focus of work shifted to a first design attempt for Application Control. This is the part of the Data Collection Framework software that connects with the Online Software on one side, and coordinates the handling of threads in multithreaded Data Collection Applications. A rough draft of a design has been circulated and generated useful discussions. As a first tangible result, a small example implementation for that design draft has been coded and is being used to gain experience and judge the usefulness of various design choices. This example software is expected to evolve into a reference implementation, in accordance with the evolution of the design itself. Main components are a small set of C++ classes formalizing a finite state machine and an interface that provides for uniform handling of concurrently active threads.

1.6.4.1.4 Arch. Design Travel

Milestone	Baseline	Previous	Forecast	Status
Arch Design for Integ Study Compl	30-Sep-01	--	30-Sep-01	On Schedule
Prototype Project Assy Compl	30-Sep-01	--	30-Sep-01	On Schedule

1.6.4.2 Global Production

1.6.4.2.1 Global Prod Eqmt — Robert Blair (Argonne National Lab.)

(entered on Saul Gonzalez's behalf, RB)

Werner Wiedenmann has instrumented all Athena code, including Gaudi, using TAU. After benchmarking the transient store access code (StoreGate), he identified bottleneck areas in the software. Due to this work, the StoreGate authors optimized the code, providing a five-fold increase in performance. Werner has also started to instrument the XKALMAN (tracking) and calorimeter offline algorithms. The aim of this work is to validate the use of the offline software in the trigger environment.

A first pre-draft of the HLT SW design document has been finished. This document summarizes the design work carried out in late March and May.